THE TELEGRAPHIC JOURNAL AND

Electrical Review.

VOL. X.—No. 222.

THE UNITED TELEPHONE COMPANY

v.

MACLEAN.

IN our issue of the 11th inst. we commented to a slight extent upon the evidence of the complainers' witnesses. This evidence, which was emphatically favourable to Bell and Edison, was made doubly so by the very clever and detailed speech of the complainers' counsel, the Lord Advocate. There are numerous points in this which we think might be placed before our readers with advantage. But before doing so, we think that the trial showed a great deal of unnecessary evidence for the matter then at issue, although this may be beneficial in future proceedings. The United Telephone Company sought to show that the respondent had infringed the patents of both Bell and Edison whilst the latter in defence urged that both these patents were invalid, and therefore there could be no infringement. As a matter of fact, it would have been the best and clearest course to have made one trial decide (in the Scottish Court) whether the validity of the patents should stand, and then judgment having been given, say, favourably on this point, a separate suit might have been entered into to consider the matter of infringement. It seems to us it is to be regretted that such a course should or could not have been adopted, as then both questions would have been clear and distinct, whereas now the validity of the patents and the infringements thereof must be linked together, thereby causing a certain amount of confusion. However, one thing may be considered as certain, for although the respondent did not show his strength, the complainers have shown their weakness in several points, and this will doubtless be duly taken advantage of by their numerous antagonists.

To return to the Lord Advocate's masterly speech, which commences thus:—

"There are two things set out in a patent of this nature, and which it is alleged the respondents have infringed. These two patents may shortly be described as the Morgan-Brown patent, patented in this country; Bell's invention, a communication from abroad; and Edison's patent, also a communication from abroad, but patented in Edison's name in this country. Now we complain that both these patents have been infringed, and the complex instrument which we used and which has proved to be of such enormous commercial value, probably a value which will daily increase, consists of a combination of the two inventions specified in these two patents, and as we set out so long as these two patents were in different hands, it was not possible for any one to have the best instrument. These patentees, however, sensibly combined their inventions into the United Telephone Company, and thereby each bringing into the co-partnery a very valuable contribution, the one bringing the best receiver, and the other the best transmitter, they two have, as we submit, the best telephone ever discovered."

Mr. Mackintosh, in his reply for the defence, very justly contradicted this presumptuous statement, and gave conclusive proofs that instead of Edison's being the best transmitter it was probably the worst, and had never been practically employed. In arguing upon the Bell patent in respect to its being said to be void, through the description of it as given by Sir William Thomson at the meeting of the British Association at Glasgow, the Lord Advocate says:—

"I think it cannot be doubted that any disclosure to void the patent must contain as full and as distinct and useful information with respect to what the invention is and the mode of carrying it out as does the patent itself. It is not enough for somebody to say that there was a machine shown which was the machine afterwards patented, if that apparatus needed any explanation or anything to enable it to become useful; in short, it must be something which conveys not only to persons of the highest skill, not only to persons of unique skill—as I think it will be proved in this case is the only pretence conveyed to any one—but it must be such as in the ordinary language of the patent law will enable a workman of ordinary skill in the department of work to which the invention relates to construct that apparatus.....In Hills *v.* Evans, No. XXXI. *Law Journal*, Chancery 463, the law is stated very clearly. In giving judgment in this case, Lord Chancellor Westbury said, 'The antecedent statement must (in order to invalidate a subsequent patent) be such that a person of ordinary knowledge of the subject would at once perceive, understand, and be able practically to apply the discovery without the necessity of making further experiments and gaining further information before the invention can be made useful. The information as to the alleged invention given by the prior publication must, for the purposes of practical utility, be equal to that given by the subsequent patent. The invention must be shown to have been before made known. Whatever, therefore, is essential to the invention must be read out of the prior publication. If specific details are necessary for practical working and real utility of the alleged invention they must be found substantially in the prior publication. Apparent generality, or a proposition not true to its full extent, will not prejudice a subsequent statement which is limited, accurate, and gives a specific rule of practical application. The reason is manifest, because much further information and therefore much further discovery are required before the real truth can be extricated and embodied in a form to serve the uses of mankind.' That is a highly authoritative statement of the law given by a judge of the greatest eminence not in law generally, but especially in this department of law. .....There is the very well-known case of Betts *v.* Menzies (ultimate reference X. House of Lords' Cases), and in that case Lord Chancellor Westbury says that to void a new patent it must be clear that 'the antecedent specification discloses a practicable mode of producing the result which is the effect of the subsequent discovery:' and Lord Colonsay, sitting in the House of Lords (L. R. 5, H. L. 2), says, 'It is not enough that there has been in a former patent a general disclosure of the object to be attained, unless there is a specification clearly pointing out the mode of attaining it.' If that is true in a patent it would be still more true in a publication, which is not a patent."

His long and elaborate argument continues in the analysation of already decided patent cases, and he then alludes to the visit made by Sir William Thomson to Professor Bell in America, 1876. After commenting at length upon Bell's communication to Sir William, he says:—

"Well, the part of the invention we are concerned with here was a receiver. According to Sir William Thomson, Bell himself said that the thing he was working at was merely experimental. According to Sir William it was not complete even in the knowledge of Bell at that time, and it is important to keep in view that Bell did not patent it at all till 1877, and no human being published it, for the reason that no human being knew of it.....I am only referring now to what passed in America for the purpose to show that if Sir William Thomson, when he saw and heard, did not understand this receiver at all, and it never once entered into his mind how that receiver could be got, least of all did he ever think that its power of speaking was due—and it is very doubtful if any power to speak is due—to the tympan or diaphragm being in contact all round. Sir William had not an idea of that. Bell had not an idea of that, and Sir William Thomson says that, so far as he can recollect, when he heard that speak in America it was not kept close down. You had to keep your ear near it, but he said that when it was pressed down it seemed to kill the sound. Therefore I think Mr. Conrad Cooke must be mistaken in what he said, and it is quite plain that Sir William Thomson could not have said it, because he had not the knowledge to say it. This is just an illustration of what we are quite familiar with, that

men looking back upon the past in the light of subsequent acquired knowledge, mix up what they have since learned with what they knew before; and I say without the slightest fear of contradiction, that Mr. Cooke is mistaken in this matter, because his evidence will not stand against that of Sir William Thomson, and Sir William has told us that he could not say so himself because he had not the knowledge himself. He certainly does not inform Mr. Cooke..... I am at a loss to know how he told anybody, because he in his own statement said he did not know how to, and he never could, make it speak, even in his laboratory—that it has never uttered a word. No man has penetrated that box, and until Bell had made the discovery there was not a single man who knew the law that a metal plate would reproduce speech when fixed in that way."

The Lord Advocate in conclusion maintains that there was no prior publication to Bell's patent, and that consequently the attempt to upset it fails deservedly, because it is undoubtedly an attempt on the part of two gentlemen of *infinitely less knowledge and skill* than those examined for the complainers. The italics are our own.

Mr. Mackintosh, in contesting his opponent's arguments, showed considerable skill and intelligence in such technical matters, and without considering as to whom the honour of the invention is due, but merely looking at the matter of the patent alone, it is a question not to be lightly decided as to which counsel got the best of the controversy as regards Bell. We will place an extract of Mr. Mackintosh's speech before our readers, as we have done with that of his adversary. He commences:—

"Now, with regard to Bell, the point there is a very narrow one. The question is whether Mr. Morgan-Brown was the first person to bring Bell's receiver to this country.....Now, in order to see whether there was disclosure of this invention in September, 1876, let me first ask your lordship to consider what the principle of the invention is to which this question relates.....The two modifications of the fifth plan are in practical use, and have been improved up to the point of practical use. The permanent magnet is the one, and the electro-magnet with the battery in the line and the local battery, is the other. I am not taking these. The modification I am taking is the modification described in the fourth plan, which cannot be said to be successful, but which is claimed nevertheless, and it consists in modifications, first, of an electro-magnet; second, a metal disc attracted by the magnet when charged; and, third, a battery in the line. These are the three features, and I am far from saying that that is a particularly useful invention, and that it works well, or will ever work well, nor that it is so useless as to bar a patent for utility. But it is no objection to advance that the instruments I found on do not work well, because there is no evidence that this instrument works well. Yet Mr. Morgan-Brown has claimed it, and the question is whether there was a disclosure prior to December, 1876, of this imperfect instrument. Now let us see what the novelty of this invention is as claimed in the specification. It consists of what I may say is an improvement—namely, the substitution of a metal disc for the membrane disc, which had previously existed in Graham Bell's previous receiver, and which was disclaimed in that Morgan-Brown patent. There was an instrument used as a receiver which had an electro-magnet, a battery in the line, and which had, beside the electro-magnet, and directed by it and vibrating in connection with it, a membrane disc. With these three things before 1876, before Morgan-Brown's patent was ever heard of—and that is conceded, and appears on the face of Morgan-Brown's patent—I pray your lordship to note that the only invention which is claimed under the fourth plan is an improvement on what I may call the membrane telephone, the improvement consisting simply in the substitution for the membrane disc of an iron disc fastened round its periphery by a certain system of wooden nippers. Now, my lord, the question is—the invention under this claim being reduced to that very narrow point—Whether there had not been before December, 1876, a disclosure in this country of the substitution of iron plate for the membrane. We say that in September, 1876, that substitution was disclosed, and so far, my lord, there is no controversy. There was an instrument described and exhibited by Sir Wm. Thomson at Glasgow which contained all the features of the instrument now claimed, with this difference, that the metal plate, in place of being fastened down, was, as shown in the model, standing up more or less, or not fastened down. Now the whole case of the complainer rests upon that—upon the metal disc not being fastened down, but standing up. If the disc had been shown by Sir Wm. Thomson, or in the drawings in *Engineering*, as fastened down, the case would have been at an end, and that would be the very instrument, whether it works well or not, which is claimed in the first claim. But then it is said that there was a valuable discovery, that the merit of the invention was in the fastening down to the instrument the lid or disc. I say, my lord, that that was not an invention. It was not a subject matter for a patent, and for this reason that the holding of the lid down was under the circumstances an absolutely immaterial thing, seeing that so soon as the instrument was at work the holding down was effected as matter of necessary result. You cannot have a patent for an improvement which arises by way of necessary result, and which any person making or using the instrument would effect for himself, and quite as well, and virtually in the same manner. Just suppose that anybody reading the description in *Engineering*, or hearing Sir Wm. Thomson's lecture, had desired to make a telephone receiver on terms of the instrument described by Sir Wm. Thomson, what would he have done? In the first place he would have gone back to Bell's publication, which is printed, and to which I need not refer again, which explains how the instrument is to be connected with the battery, what amount of resistance the instrument should have, and what amount of electric force is required to deal with that resistance. He would then have constructed the instrument [model exhibited], and he would then, following Bell's directions, have taken a five-carbon battery and set the machine going. My friend represents that the description in Bell, to which reference has so often been made, and which is in the print, referred to the membrane telephone. Of course that is so, and it is shown in the article in the *Journal of the Telegraph*, August 1st, 1876, 'Researches in telephony.' My friend is quite correct in saying that Bell is dealing with the membrane diaphragm; but in this matter of the force of the current the one principle was quite as good a rule, for the iron disc and the proportion must be preserved. The article says: 'Two single pole electro-magnets, each having a resistance of 10 ohms, were arranged upon circuit with a battery of five carbon elements: the total resistance of the circuit was about 25 ohms.' Taking that proportion, any person could have constructed an instrument something like this, and could have used a battery of five carbon elements, and what would have been the result? The moment the electric current was applied down would come the lid..... Now, it comes to this, that there can be no patent for an improvement which is a mere declaration of a necessary result, and it is of no moment whether this worked or not, or whether it worked well or not. So far as the evidence goes this instrument works as well as any instrument ever made in terms of Plan 4. But supposing for argument's sake that you are at liberty to use a receiver of that description, attached only at one point and held down by a magnet—that is not the instrument described in Morgan-Brown's patent. The question is whether there is such a merit in the invention of holding down by wood what is necessarily held down by the magnet. The improvement is really this: I will effect by wood nippers what the magnet effects automatically when the instrument is at work. I submit that is not enough to warrant a patent. Something has been said about the attempts to construct the instrument.....My lord, the time after all was only three months. The article in *Engineering* was not published till after Morgan-Brown's patent came out. The truth was that, Sir William Thomson having given the public the information, Mr. Morgan-Brown was too sharp for anybody else, and he produced the patent for it within three months after Sir William made the publication. The point depends on the state of prior knowledge. I start with a certain state of prior knowledge, which shows that the invention existed up to a certain point, and that this was an improvement—the substitution of an iron for a membrane disc. That is all that is claimed. This improvement was disclosed of substituting a metal disc. Is there room for a further patent, which was to consist of a further improvement by holding it down by wood, seeing that the machine itself holds it down as soon as it is put into operation? There is no contribution to the stock of knowledge in informing the public that they may do with wood what will be as well done without the use of wood, and by the instrument. Mr. Salvesen further points out that really when Morgan-Brown came to specify he did not specify how it was to be fastened..... You must have a material contribution to public knowledge; and it is for your lordship to say whether that material contribution was given by a man who simply said fixing down by wood what was already fastened down by its own action. In conclusion, it all turns upon the absence of a successfully manufactured instrument during these three months. Sir William Thomson has been asked why this instrument did not speak, although a similar instrument was speaking in America; and though there may have been some defect in the instrument, he did not seek to construct another form of instrument and make his experiments with that. If he had he would have made an instrument like this model, and it would have spoken at once, and it would have done as well as Morgan-Brown's.'

In a few concluding remarks on this portion of the late trial, we must confess that we cannot see that it should have been impossible for any one to make such an instrument as that described by Sir W. Thomson, and capable of articulate speech, simply because the eminent scientist himself failed utterly in making it work. Such a conclusion is quite opposed to scientific progress, for it is frequently the failure of one man which makes another successful, and that with the same instruments and with the idea of attaining the same object. In fact, if we are correct in our sense of the evidence given, Mr. Conrad Cooke actually did make such an instrument from Sir William Thomson's description, which we stated in our first article.

Again we must protest against the Lord Advocate's statement, that until Bell made his discovery there was not a single man who knew that a metal plate would reproduce articulate speech when fixed firmly round its edges. The toy telephone, known to all of us in our boyish days as the "Lovers' Telephone," was made with a firmly-fixed plate or tympan. The whole apparatus consisted of two tin cans, whose bottoms were connected with each other by a piece of string or wire of considerable length. The vibrations from one to the other are certainly not produced electrically, but the action must be the same. These same toys may be made, and were often made, with wooden cylinders closed at one end with a parchment or bladder tympan, the working of these and of the first described being identical. It is therefore very strange that a membranous tympan did not suggest to Sir William Thomson a metallic one, when both had been in use for so long as toys. In fact, it was a

retrograde movement on the part of Bell to use a tympan at all which was not firmly fixed round its edges. The Lord Advocate also evidently speaks without much consideration, or he does not qualify his remarks, when he describes Mr. Cooke and Professor Blyth as being gentlemen of infinitely less knowledge and skill than Sir William Thomson, Sir Fredk. Bramwell, and others. However eminent a man may be in a special science, there are probably many men who devote all their time to a certain section of that science, and may therefore be much more capable of explaining and deciding such a point as the one in issue, than an eminent professor who has not really time to deeply study all branches of his profession. Want of space compels us to leave over the more important matter of the "Edison Transmitter," "Microphone," &c., and we must therefore take another opportunity of looking into this.

ELECTRIC LIGHT MEASUREMENTS.

By H. R. KEMPE.

V.

LIKE galvanometers, the Siemens electro-dynamometer is not susceptible of great accuracy when the readings are very low, but unlike galvanometers, the higher the readings the more accurate are the results. Thus, for example, 5° of torsion of the spring represents a current (in the instrument shown by fig. 6, page 96) of 7·93 ampères, whilst 5° more, that is 10° in all, represents a current of 11·23 ampères. In other words, a range of 5° of torsion only, represents a difference in the current of

$$\frac{(11{\cdot}23-7{\cdot}93)\ 100}{7{\cdot}93} \text{ per cent.} = 42 \text{ per cent.}$$

If however the current had been 66·38 ampères, which corresponds to a torsion of 350°, then 5° more of torsion, or 355° in all, represents a current of 66·86 ampères, consequently the range of 5° of torsion here represents a difference in the current of

$$\frac{(66{\cdot}86-66{\cdot}38)\ 100}{66{\cdot}38} \text{ per cent.} = {\cdot}72 \text{ per cent.;}$$

and a greater degree of torsion would have rendered the error still less.

The table supplied with the instrument is calculated so that the latter can theoretically be used for measuring currents varying from 1·05 to 66·86 ampères in strength. The thin wire coil is to be employed when currents of from 1·05 to 19·87 ampères are to be measured, and the thick wire coil for currents of from 3·54 to 66·86. The numbers of degrees of torsion representing various currents are all multiples of 5; thus the first calculation on the table (thick wire coil) is 1°, which represents 3·5 ampères of current; the next is 5°, representing 7·93 ampères; the next 10°, representing 11·23 ampères; and so on. Practically, the instrument cannot well be adjusted to a closer degree of accuracy than 5°.

The thin wire coil having about three times the magnetic effect of the thick one, requires, for a definite current, that the number of degrees of torsion to bring the needle back to zero be about three times that which is required in the case of the thick coil; in other words, with the thin wire coil we can practically measure currents to about three times the degree of accuracy which is possible with the thick coil; but, on the other hand, the highest current which we can practically measure with the thin coil is about one-third only of the highest current which can be measured with the thick coil. Strictly speaking, a measuring instrument ought to be able to make every measurement to the same *degree* of correctness. Accuracy in a small magnitude is of just as much importance as accuracy in a large magnitude. In "electric light measurements" it is very rarely that a less degree of accuracy than 10 per cent. can be considered sufficient; and in cases where the competition between gas and electricity, as regards cost, runs close, a smaller percentage than 10 per cent. may turn the scale one way or the other, consequently it is highly important in making measurements to know to what degree of accuracy the measurements can be depended upon. In the case of the Siemens electro-dynamometer, which we have referred to, we can see that the lowest current which can be measured consistent with a degree of accuracy equal to 10 per cent. is 5·76; for the next current below this on the table is 5·25, and therefore we have

$$\frac{(5{\cdot}76-5{\cdot}25)\ 100}{5{\cdot}25} \text{ per cent.} = 10 \text{ per cent. nearly.}$$

If we require to be accurate within 1 per cent., then the lowest current we could measure would be 16·77, as the next current below this on the table is 16·60, and we therefore have

$$\frac{(16{\cdot}77-16{\cdot}60)\ 100}{16{\cdot}60} \text{ per cent.} = 1 \text{ per cent. nearly.}$$

Since the percentage of accuracy is equal to

$$\frac{(\gamma-\gamma_1)\ 100}{\gamma_1} = \left(\frac{\gamma}{\gamma_1}-1\right)100,$$

where γ is a particular current, and γ_1 the current nex below it on the table; and since

$$\gamma^2 : \gamma_1^2 :: \phi : \phi_1$$

where ϕ and ϕ_1 are the degrees of torsion corresponding to the currents γ, γ_1, therefore

$$\text{percentage of accuracy} = \left(\sqrt{\frac{\phi}{\phi_1}}-1\right)100;$$

and as the smallest difference to which we can practically read is 5°, therefore

$$\text{percentage of accuracy} = \left(\sqrt{\frac{\phi_1+5^\circ}{\phi_1}}-1\right)100 = x, \text{ say.}$$

Therefore

$$\sqrt{1+\frac{5^\circ}{\phi_1}} = \frac{x}{100}+1;$$

therefore

$$1+\frac{5^\circ}{\phi} = \frac{x^2}{10000}+1+\frac{x}{50};$$

therefore

$$\frac{5^\circ}{\phi_1} = \frac{x^2}{10000}+\frac{x}{50};$$

or,

$$\phi_1 = \frac{50000}{x^2+200\,x}$$

which shows us the smallest number of degrees of torsion which must be given to the spiral spring when measuring a current, in order that the latter may be measured to an accuracy of x per cent. For example, suppose it was required to be able to measure currents of 10 ampères and upwards to an accuracy of 1 per cent., then

$$\phi_1 = \frac{50000}{1+200} = 248^\circ;$$

showing that the electro-dynamometer must be so constructed that not less than 248° of torsion have to be given to the spiral spring in order to bring the needle back to zero when measuring currents of 10 ampères and upwards.

From the construction and principle of the electro-dynamometer, it must be evident that the accuracy of the absolute results obtained by its means must depend entirely upon the torsion of the spiral spring remaining constant. It seems possible that change of temperature and frequent use might change the value of the torsion, but the writer is not aware whether this point has been satisfactorily settled. The instrument might probably be made of more value if its coil were composed of a large number of turns of thin wire, shunted by a thick wire shunt. The latter would be used when measuring the strong currents, whilst the correctness of the instrument could be verified by sending a comparatively weak current through the unshunted coil. It is not often that powerful currents of an accurately known value can be had for the purpose of verifying the correctness of an instrument, though weaker currents are almost always obtainable.

(To be continued.)

THE CENTRAL AND SOUTH AMERICAN CABLES.—The Silvertown Telegraph Company has received a telegram from Mr. W. Falconer King, announcing the completion, on the 14th inst., of the Chorillos-Payta section of the Central and South American Telegraph Company's cables; and that the *Dacia* would start on her homeward voyage on Monday, the 20th inst. Their ss. *International* arrived safely at the moorings off the Silvertown works, on her return from Mexico, on Saturday, the 18th inst.

THE MARSEILLES-BONA CABLE.—We hear from Marseilles that while repairing the 1870 Marseilles-Bona cable the repairing vessel of the Eastern Telegraph Company broke their own duplicate cable, which was laid in 1877, and also interrupted the 1880 Marseilles-Algiers cable, belonging to the French Government. As the breaks were close to Marseilles, communication by the three lines was re-established in a couple of days.

THE TELEPHONE CASE.

(*Continued from page* 122.)

LORD M'LAREN: It is a flat surface.

Mr. MACKINTOSH: Yes; a flat surface, and therefore there is nothing there at all inconsistent with the general scheme of the electric tension regulator, namely, compression with an elastic or partially elastic surface.

LORD M'LAREN: I do not think there is evidence in the case that in all Mr. Edison's forms the minute undulations caused by the sound would cause a compression of the mass. It would appear from the specification that Mr. Edison thought it did; that the compression was not confined to the surface, but I do not think it has been shown that these modes would act by substance compression any more than the respondent's mode.

Mr. MACKINTOSH: That, my lord, is what I am going to found upon as distinguishing my material. From these things, I am going to show that that is itself a sufficient differentia, that I use a material which is not capable of acting in the manner in which Edison contemplated his material should act. It is enough for me, however, here to show that the materials Edison described are all materials in which, if pressure were applied, the pressure would act throughout the mass, and by a variation of elasticity, which of course would operate through all the mass. There is nothing, so far as we have got, certainly not in the figures, which suggests that he had in his mind any other mode of action than, for instance, that which the printing press produces, a pushing motion on any material through which the current was passing. But it may be said that in the letterpress there is an instrument described not shown in the drawings, but which, nevertheless, is one of the instruments claimed, and that instrument proceeds not upon the principle of pressure, but in varying the extent of contact; and the passage referred to is the passage which was not, I think, Sir Frederick Bramwell's sheet anchor or forlorn hope of the complainers towards the close of the case. At the top of page 6, when Sir Frederick Bramwell was first examined, pressure was the principle, and pressure was the principle in Theiler's, and when it became manifest that there was a serious question as to whether the respondent's instrument operated in the way of pressure. Till then the witnesses took themselves to this passage on the top of page 6, and their efforts have since been directed to spelling out the language of that somewhat mysterious part of the disclosure of a new and alternative principle, variation of resistance by variation of extent of surface contact. Now, here again comes in the fact, though my learned friend throughout his argument overlooked that Edison is here claiming instruments, an instrument which he has described, and there is another instrument within his patent which is not described. I cannot be held to have infringed by adopting a principle, because there is no claim for a principle, the claim is merely for certain instruments, and supposing the passage on the top of page 6 to be what it is said to be, it is simply a description of a certain instrument, and my learned friend, in the argument I am dealing with, would catch me in this way, that I am taking a mere modification of the instrument described in page 6.

LORD M'LAREN: I understood that was the view the Lord Advocate maintained.

Mr. MACKINTOSH: Well, there is an instrument, and it is said that I am taking a modification of it. The first question is: is there any adequate description at that place of an electric tension regulator? My lord, I do not think any of the complainers' witnesses were bold enough to say that that would be a full and adequate description of the instrument. It is certainly very odd if it was intended to be a description of an instrument that there was not any figure in the drawings corresponding with it. There is the most anxious exhaustion of the various forms in the drawings of the electric tension regulators; but there is not a line in the drawings to correspond with the passage on the top of page six, or to indicate an instrument was mentioned, and when you come to the evidence of the respondent's witnesses your lordship will judge whether it does not demonstrate upon grounds which command themselves to reason, that the description on the top of page 6 wants all the essentials of description. No workman of ordinary ability would thereby be enabled to make the instrument. He would not know wether the discs were to be conductors or non-conductors, how much plumbago to put on, and everything would depend on the way in which the plumbago was put on, and upon the material used. Everything as to the acting of the instrument would depend on the material used, and the way it was put on. Therefore, my lord, I take it that that passage won't help my learned friend, because it does not describe the instrument it professes to describe. But then in the second place I think I am entitled to say this: that really upon the complainers own showing the paragraph in question is only another example of the principle of compression. There is no variation, in the case I am now dealing with, of the extent of surface contact caused by the variable shaking, of, say two pieces of carbon one against the other. It is not a case of one piece of carbon resting upon half a dozen points of contact, and then by a certain jolting motion being made to rest upon twenty points instead of six. The suggestion here is not of a loose and regular motion, but of a regular compression in one direction of the two plates. The two plates are presumably—there is nothing else suggested—to be used just like the letter-press or printing press, just in one way. Now, if that were observed, how would the variation be produced? If the substances were elastic there would be no variation in the surface contact. The substances would remain just as they were. Therefore we may put the case of non-elastic substances out of view. But take the case of elastic substances—of a tolerably elastic substance—on either disc. What is the effect of compression there, and how is the extent of surface increased? Why, simply by compression. Suppose you take a sandwich and compress it, you extend the surface; that is just another example of compression, and so here I take it that Edison was not departing in the least from the general principle of compression when he gave the hint suggested at the top of page 6. You may make your compression by means of two discs, and when that happens the compression operates by flattening out the substance of the two discs by making the area of compression a little larger. I take it as being regular compression, compression on the principle of the letter-press, and if that is so, then there is a minute enlargement of the area. You are dealing with minute factors in this case throughout, and all I say is nothing in this passage at the top of page 6 is at all a departure from the general principle of compression, or, as described by Mr. Cooke, the principle of variation of density.

LORD M'LAREN: Any pressure capable of being produced must be by excessively rapid tremor, such as by the vibration of metal plates—can you call that compression? If you pressed it to any degree conceivable, is it the cause of compression in your sense? I should say it would destroy the action of the regulator.

Mr. MACKINTOSH: It is just there the difficult comes in. All this depends on how the plumbago is put on, and how much is put on, and what sort of disc it is put on, but that is not described and perhaps it is going out of our way to speculate what would be the result if it had been fully described.

LORD M'LAREN: The theory of the specification, the meaning of it as it occurred to me, is that it begins by describing a complete instrument, both the tension regulator, that is, the pieces of carbon or fibre or whatever it is, and the apparatus connected with the circuit to make it workable. Then, in the second place, he goes on to describe different kinds of regulators that may be used—water, discs, pressed plumbago—then thirdly he describes variation in the instruments that are necessary to adapt the machine as a whole to these different kinds of regulators to be used. But I do not see in point of fact which of the instruments is to be used in connection with the plumbago.

Mr. MACKINTOSH: I do not think it is seen, and that is most important with reference to the first part of my argument. You have about the Edison various sets of appliances and very different for applying the pressure to the tension regulator, and there is not in the specification a word to show which of these sets of mechanical arrangements is to be used with reference to the instrument at the top of page 6. For example, are you to use the two batteries set out at C, on figure 10, or are you to take the very complex arrangement indicated in figure 12, and which proceeds on the introduction of a permanent magnet or vibrating tongue, or are you to take the arrangement at figure 1? Which of the alleged known essential sets of mechanical contrivances within the specification is to be applied in carrying out this alleged invention at the top of page 6, if it is to be regarded as a separate instrument, claimed as such, and of which it is said that I have constructed a mere modification. But then, my lord, I have this further to say, that not only does Edison not describe or suggest any principle other than that of compression and compression throughout the mass, but that his instrument, according to the very essence of it, cannot possibly depend upon a variation of pressure at the point of contact or a variation of extent of contact at the point of contact, and that for two reasons. In the first place because in telephones where carbon pencils are used the surfaces change with the current as explained by Mr. Cooke, and secondly because of the thermo-electric currents referred to by Mr. Blyth, which introduced a disturbing element in the proposition which is the law of the instrument. The changes of surface at the point of contact caused by the detrition of the carbon would prevent the variations of pressure at that point being at all proportional to the magnitude of the sonorous vibrations. Yet upon Edison's theory it is vital to him that whatever the pressure, so far as employed, it should be directly in quantitive proportion to the magnitude of the sonorous vibrations. Therefore these changes of circumstances destroy the law of the instrument in the same way, the existence of thermo-electric currents if carbon is used destroying the action of the instrument because currents may come in which may destroy more or less currents upon which the action of the instruments depend, and vary their strength or weakness in a direction opposed to that caused by the sound of the vibrations. In other words, you have on both of these grounds a disturbance of the law of pressure at the point of contact which makes it quite impossible that Edison's instrument could work unless he depended on pressure throughout the mass—in other words, if he depended on pressure at the point of contact or variation of surface at the point of contact. That being so I put it to your lordship that if we are to look upon the principle he expresses Edison's

works on the principle of compression over the mass. Now, what is the principle of the respondent's instrument? And here, my lord, I think I will take a point which I proposed to have taken earlier, and it is this: The respondent's instrument, whether it works upon the theory of pressure or not, is not proved to involve the maintenance of a closed circuit, while Edison's instrument, upon the very language of his claim, involves the maintenance of a closed circuit as the essential element of his claim. I do not need to refer to the passages where he puts the necessity for the closed circuit forward in his specification, because in his claim, as your lordship will see, he confines his claim to the use of the electric tension regulators for varying the resistance of a closed circuit. It is, therefore, incumbent upon him to prove before he can attack me as an infringer—the onus of proof is upon him—that I maintain closed circuit. My lord, has he proved that? It is not necessary for me to prove that my instrument operates on the make and break principle. He must prove that it is not and does not to any extent, I mean to any extent that can by any possibility affect the action of the instrument. How do the facts stand there? Your lordship is called upon to arbitrate between two rival schools of philosophers. The controversy upon which this case really hinges is one which at this moment is vexing the whole scientific world, and dividing the whole scientific world into two parties. You are asked to say whether the microphone and its modifications is an instrument that works upon the principle of Edison's patent of 1877. I have not heard on any high authority, except Sir William Thomson, who takes that view, and it has come out in the evidence that very high authorities take the other view.

LORD M'LAREN: Can you refer me to any passage on that point? I was under the impression that your witnesses were only stating it as their own opinion?

Mr. MACKINTOSH: There are references made to the controversy going on between Professor Hughes and others, and his invention made a great stir and there was a great controversy on the subject.

LORD M'LAREN: Yes; on who was entitled to the merit of the invention, whether it was a new invention of Hughes' or merely a modification of Edison's, but I did not understand that the controversy was as to the mode of action, but rather as to person.

Mr. MACKINTOSH: It is really this—on what principle the microphone depends. Mr. Edison maintains that it depends on the principle of compression, other people say it depends upon the principle of compression—on compression at the point of contact. Others say that it depends upon the principle of variation of surface at the point of contact.

LORD M'LAREN: That is the same as the second, I think?

Mr. MACKINTOSH: Not on compression at the point of contact, but variation in the circumstances of the contact, that is to say, you vary the contact when you superinduce the point A upon B, while the next moment A may rest on C where the conductivity is of a different degree. And the next theory of the microphone is that it operates, not by variations of pressure, or extent, but by the circumstances of the contact; and then, perhaps, the most plausible theory of all, that the microphone acts upon the principle of a refined make and break, that theory being supported by one set of phenomena at least which appear to support it very materially, viz., the action of the sparks which are emitted in the dark, when the instrument is at work. But I am at present concerned only in this: confessedly Edison must prove that there is no make and break in my instrument; he must show that I maintain a closed circuit. Now he has not shown that, because it is at least as likely as not—I will not put it higher in the meantime—that my instrument and the microphone proceed on the principle of make and break. There is nothing to show that you cannot transmit articulate sounds on the principle of make and break. Sir W. Thomson said that he would not say that it was impossible. It had never been done to his knowledge, but we know that it was done in Reiss's instrument, if in a very coarse way. Then with regard to Graham Bell's instrument, Mr. Cooke explained to your lordship that there was a very minute make and break even in Bell's receiver, and it is Professor Blyth's opinion, and in this matter Professor Blyth is a high authority, because he has made this a special study for years, is that the preponderance of authority and probability is in favour of the microphone acting on the principle of a refined make and break. Now, if that is so, there is an end of the case, but the complainer has no proof that there is a closed circuit in the Theiler instrument, or that he has negatived the make and break. I pass now to the question whether, apart from that the principle of the microphone is not at least established to be a different principle from that of Edison. If Edison's principle is that of compression, *cadet questio*, the admissions of my friend yesterday prove that. Whatever may be doubtful, one thing is certain, that where carbon is used you cannot have compression throughout the mass according to the sounds or the pressure produced by the sounds.

LORD M'LAREN: Before leaving the last point, the difficulty occurs to me in assuming that it is necessary to the complainers to make out, as a matter of fact, that it is a closed circuit. Is it not enough to specify that the mode of action of the two instruments is identical almost on that particular point, because it may be, you know, that the action was by make and break, or an approximation to it, the break being so slight as not entirely to interrupt, but merely to increase the resistance of the electric current? Would it not be almost self-evident that that would be also the mode of action in Mr. Edison's instrument? They are so analogous, whether one be an imitation of the other, they both cause great and irregular variations in the resistance; it would be difficult, consistent with sound induction, to assume that they worked by the application of different laws.

Mr. MACKINTOSH: In the first place I take it that the principle of the make and break, applying to the Theiler transmitter, by no means implies that the same principle operates more or less in the Edison transmitter. The make and break depends upon the delicacy or comparative looseness of the contact. Now there is not an example throughout Edison of delicacy of contact, or any aim at delicacy or looseness of contact. On the contrary, every one of Edison's regulators is screwed up to the maximum of tightness. He aims at a maximum of tightness, and the reason he does that is just this. His object was to close up every atom of make and break—to exclude make and break even in the most infinitesimal form; and therefore it does not follow that—because my three pencils, one of them dangling against the other two, would make a make and break—any one of Edison's would operate in that way. But suppose it did, we come back to the question whether, when he is claiming the feature that he regards as then his patent, must then the specification describe that feature? He cannot claim two instruments which happen to act upon a principle. If he is to take his stand upon a principle, it must be one which he specifies, so that people may know what they may take, and what they may not take. Accordingly I find that he repudiates the notion of make and break, and claims only the electric tension regulator when working with that closed circuit. Then I say he cannot attack an instrument that is founded on the principle of make and break, however minute that make and break may be.

LORD M'LAREN: It may not be absolutely closed; but his descriptions and his figures show you what he means by closed circuit, consistent with his plan of varying resistance—that is, of course, always on the supposition that the mode of action of the two instruments is identical, and that may not be so.

Mr. MACKINTOSH: That may not be so, but I only say the object running through his principle is to make a circuit as close as possible, I believe, consistent with the working of the instrument; whereas my instrument proceeds on the converse method of having as great a looseness of contact as is consistent with the maintenance of the continuity as will make the break sufficiently refined. I point out that Edison in his specification at page 5, letter 18, says it is not practicable to open and close a line circuit for transmitting the human voice. Any one reading this specification desiring to know what he might take and what he might not take, would be entitled to assume that if he dispenses with the closed circuit which Edison desires, and adopted even minutely the make and break which Edison warned him against, he was outside the patent, especially if the results he got, improved immensely by the introduction of the minute make and break, which Edison was apparently so anxious to avoid. I am entitled to say that this make and break must be a very material difference after all when the introduction of it was attended with so important results. Whatever is established here this is established, that the Theiler regulator does not proceed on the principle of compression applied to the mass; and for this reason the Theiler uses carbon, and carbon differing from all the materials specified by Edison; that while the resistance in the carbon varies when pressure is applied to the point of contact, it does not vary at all with pressure applied throughout the mass. That was the object of the experiments in so much detail, not to show, as the Lord Advocate supposed, that carbon was absolutely incompressible, or that carbon operated upon in no manner could vary resistance, but that it did vary resistance in the slightest degree by compression throughout the mass; that it did differ essentially in that respect from elastic fibre, and the only way by which carbon could be made to vary its resistance was by variations of pressure at the point of contact. The first two experiments, the one with the voice and the other with the tapping, showed that with a considerable force throughout the mass the carbon did not vary its resistance in the least; and the third experiment showed that when the pressure was affected at the point of contact a variation was produced; and so the experiments conclusively demonstrated this—that if the principle of Edison is compression throughout the mass, then the principle of the microphone and Theiler is an essentially different one. Then, my lord, suppose that to be so, then again there is an end of the case. I am not bound to show what the action of the microphone is. It may be that it proceeds on the principle of variation of extent of surface contact. I do not think it can be so, for the reasons I have already explained about the thermo-electric currents, and so on; but it is quite possible—and they say I am not within the Edison patent—it may be that the resistance is varied by a variation of the circumstances at the point of contact, which is not suggested by anything in Edison's patent. That kind of thing, when produced by a shaking of the conductor at the loose joint, produces what is called variation in the circumstances of the contact, which may not be accompanied by any variation of the extent of the contact, and which may certainly not be affected by the pressure proper. The law of proportion is violated in any view, and it is just one of those things which have yet to be cleared up, how, notwithstanding the operation of chance, so to speak, in determining the extent of circumstances of contact at a loose joint, yet there is a result at the receiver proportionate to what takes place at the transmitter.

LORD M'LAREN: Chance in regard to the amount of surface in contact at the time?

Mr. MACKINTOSH: Yes; and then, my lord, the way to illustrate the case is to examine the pencils under the microscope, and you find a whole series of hills and valleys; and the one pencil is resting, perhaps, upon only two or three points or projections in the pencil below it, and then a shaking comes and it may rest on half a dozen different points, or a similar number of points, but different points. But in the mean for a word or for a sound, there may come a mean of proportion that may produce the result. All these are things which are not cleared up; and things which scientific men are endeavouring to ascertain. It is not for me to assign a theory. It is one of the marvels of the present day, and whatever the microphone proceeds upon it does not proceed upon the principle of pressure which makes the feature of his instrument in his specification. And with regard to molecular pressure, it may operate; but it is plain that it is not the only thing that operates. There are phenomena in which that kind of pressure would not operate. My friend, the Lord Advocate, seemed to suppose that when the two pencils—the vertical pencils in the Theiler transmitter—were moved by the cork, or by the vibrations of the cork, towards the suspended pencil, the only action

was the force communicated through the vertical pencils to the suspended pencil, and that that was an action of the nature of pressure outwards. My friend forgot that the vibrations equally and necessarily affect the whole three pencils, and just as the vibration of the cork or the box sends the two pencils against the third pencil, so the same vibration forces the pencil back, and you cannot calculate any law of pressure as determining the relations of the three pencils. All three are equally moved by the vibrations communicated through the cork and wood and atmosphere, and although the weight operates to a certain extent to prevent the pencil being sent rudely back, yet it cannot prevent a motion of a regular character being transmitted to all three. The main thing is this—that while Edison proceeds upon compression, we proceed upon variation of contact amongst loose joints—we struggle for such looseness in the joints as is compatible with preserving a reasonable degree of continuity; while Edison, on the other hand, seeks to tighten up as far as possible. Then he proceeds on the principle of pressure; we again on the theory of shaking—of loose joints—and there could not be a better illustration of that than Professor Blyth put, that you may have two loose joints in a circuit, or you may have twenty or thirty. You may have your loose joints consisting simply of a mass of cinders in a box, and the cinders in the box are nothing more than a mass of conductors with loose joints.

LORD M'LAREN: That seemed to me rather a dangerous illustration. You suppose so many pieces all going on in a series of makes and breaks? In that case is it not almost impossible that the current will not be interrupted?

Mr. MACKINTOSH: That is just one of the marvels of this instrument. But it is an ascertained fact that a bundle of cinders did transmit articulate sounds. In Theiler you have two loose joints in the electric tension regulator; in Crossley half a dozen; in Gower-Bell about a dozen; in the box of cinders you have perhaps twenty or thirty. I do not say that the contact is not preserved there, that there is an approximate maintenance of the contact, but you have not got the closed circuit, and the principle a close circuit; and I do not think it unreasonable to assume that when departing from Edison's principle of tightness you produce such important results. I say there is some virtue in this looseness of joining however it may act, and as to that we do not know and are not bound to speculate. There are two distinctions further, and these are, I think, that we can use—that the Hughes' microphone and the Theiler transmitter can be used—without a diaphragm. There is no necessity for anything of the nature of a diaphragm in Hughes' transmitter. Mr. Cooke and Mr. Blyth showed that by just speaking of the three pencils set up upon a piece of board. And using the Morgan-Brown receiver at the other end you obtain articulate sounds, and with a cork receiver arrangement you can hear articulate sounds, although there is no diaphragm (instrument with cork receiver shown). I therefore say that even if this is a patent for certain features of the instruments, and not for the instruments themselves, I have shown your lordship that we do not proceed upon Edison's alleged principle, but, in the next place, we do not use Edison's material, or anything equivalent to Edison's material. Edison, your lordship, beyond all question does not specify gas carbon. Whatever else is doubtful, it is certain that this is not one of the substances he specifies, and, although he may specify other forms of carbon, I need not tell your lordship that one form differs from another in its physical properties in a degree having no sort of relation to its chemical properties. So the mere fact of plumbago being specified, and plumbago being a form of carbon, would by no means lead to the inference that gas carbon, which is a totally different carbon, would have the same physical properties. Accordingly we maintain that the complainer claims, when he specifies directly or indirectly, gas carbon as one of his materials. But not only so, he defines the character, the materials must all have "the character of increasing and decreasing their resistance enormously under slight changes of pressure." If you are looking for a common feature among the complainer's materials, that is the common feature—that they shall be capable of increasing and decreasing their resistance enormously under slight changes of pressure. My material is the very reverse. In that respect gas carbon, if the experiments to which I referred prove anything, is a substance which does not increase or decrease its resistance at all, except under great differences of pressure. Therefore I submit there is a substantial and great difference between the material I use and the material Edison specifies, and nobody reading Edison's specification would think of employing the gas carbon if he knew its properties, and, on the other hand, nobody would suppose that if he used gas carbon he would be possibly infringing, or make a mere modification of Edison's invention. I think the experiments directly established that plumbago would have a different appearance. Plumbago is a substance that varies its resistance enormously under slight changes of pressure. We established, again, that gas carbon, which is as different a form of carbon from plumbago as adamant, does not vary, and, therefore, there is a difference. And if you require a further illustration, Clerac supplies it, because there you have a form of carbon which was varied on slight changes of pressure, and it was on Clerac's suggestion doubtless that Edison proceeded in choosing his forms of carbon. Therefore the first point about the material is that he does not specify carbon—that we use carbon, and that the carbon is specifically different from anything he describes. But there is another different character — the character of being semi-conducting. I do not pause to consider how that semi-conducting property is imparted, whether by being itself semi-conducting or by being mixed—composed of a semi or non-conducting material. Does our instrument require a semi-conducting material? According to the whole evidence, and I think there is no conflict at all upon this point, the respondent might use not merely carbon pencils but iron nails or platinum wires. And there is no doubt whatever that iron is not a semi-conductor, but if at all clean is one of the best conductors, and yet there is no question if your lordship applies the experiments, that Theiler's instrument, the microphone, will work quite as well with iron nails as with carbon pencils. If that is so there is another and vital difference as regards the materials used. Then there is the matter of the tympanum, and I shall endeavour to deal with that very shortly. In the first place I say this upon the experiments and evidence, I think it is proved that no tympanum need be used by the respondent in his instrument or in the Hughes microphone. That goes a long way to show that the respondent does not use a tympanum in the sense of Edison. But in the next place let me ask whether we use the tympanum and the tympanum in the Edisonian sense. Now, as I said just now, it is clear we need not use a tympanum if the experiments made so carefully can be accepted. But do we use one? A diaphragm might be an ambiguous expression, but a tympanum admits of no ambiguity. It is resembling the tympanum of the ear, a disc of some kind held down by the periphery and free in its centre. And you cannot have a tympanum, in any reasonable sense of the term, where the disc that is called a tympanum is fastened down over the whole surface. The thing to which it is fastened down may become a tympanum, but the moment you attach your metal disc to another surface throughout it becomes part of that surface, and loses its character of a tympanum. That is what takes place here. In Theiler's instrument the iron disc is used. It is quite likely that Theiler (with whom I have nothing to do in defending) may have used that piece of iron in order to give his instrument the appearance of others, not Edison's alone, but Bell's and others. But I am not responsible for that. Certain it is that the cork on which the iron tympanum is resting has a much larger surface than the iron disc, and that the iron disc is fastened down over the whole surface of the cork, and in place of the circumference of the disc being fastened down, it is the surface of the cork that is fastened down, and the cork becomes a tympanum. And this reduces us to the question, Is the piece of cork used in Theiler's transmitter a tympanum in the Edisonian sense? I confess I got some light there in the language of the specification. There is nothing in that specification to show that any diaphragm or tympan was contemplated, except a metal diaphragm, and there is a good deal about that in the specification. There is first the mica diaphragm claimed in the invention. But in the first place I shall tell you what Edison means by a tympan, and I think he plainly means a metal tympan from his specification. Mr. Mackintosh referred the bench to a passage on page 5 of the specification, where Edison refers to the use of a mica tympan, because mica was almost entirely free from any resonant action, and could be employed to any desired thickness, and when secured at its edges would respond with accuracy. Proceeding, he said:—That passage shows two things, that Mr. Edison contemplated the use of some substance, some hard substance, some substance of the nature of an iron disc or a mica disc, and did not contemplate the kind of substance of which cork is an example, and I think that further appears for this reason amongst others that he rather objects to the resonant action. He, in fact, dislikes any forced vibrations operating through his instrument. He wants a diaphragm which will operate purely mechanically by adjusting, pushing, and pulling at its centre, and the next reason is this, that he talks of his diaphragm as one that is to be fastened round the edges. Therefore Edison's diaphragm or tympanum is a diaphragm, or tympanum or something similar is bent metal, which is fastened round the circumference. A drum is a very good illustration. You could not have a drum if you have the whole surface of the drum fastened down by glue to the wood. Cork is the substance which connects sympathetic tremor of forced vibration all round, and although it may be a very good material for that purpose, I do not find that any special virtue is attached to it in Edison's patent, or that there is any special virtue in it in the microphone. It is used probably to detain the sound in the microphone, as a buffer between the sound and the voice, so as to prevent an undue amount of magnifying of the voice, and, therefore, it is not to be held as designed for the purpose even of a sounding-board; it is just put in to detain the sound of the voice. And as regards the sounding box. Mr. Cooke explained that all that was necessary was a box round it. If you had no box, but a piece of pumice-stone, it would be the same. I say cork does not operate by means of the push-and-pull action at all, but by means of sympathetic tremor, and it affects the whole three pencils more or less, producing a certain looseness of motion, a certain shaking, the precise virtue of which has not, as I said, yet been accurately ascertained. How can the iron plate act as a vibrator when it is fastened down over its whole surface? It may make the cork push out and in just as the voice would do; but there would be no greater force imparted to the cork by the intervention of the iron plate, while if the sound were directly directed against the cork, at all events in practice, the result is the same, whether you withdraw the iron plate or the cork—both may be perfectly well dispensed with.

LORD M'LAREN: I think Mr. Blyth said that the action would not be quite so good.

Mr. MACKINTOSH: I must say that although I did not like to interpose that I thought the Lord Advocate was putting questions in one sense, and getting answers in another. That is a thing that goes for very little when the notes are extended, and I do not think when your lordship reads the notes as a whole that you will find Mr. Blyth has said anything inconsistent with his examination in chief. I quite admit that there is an advantage to be obtained by the mouthpiece, and I think he also said that the metal plate might assist the action by concentrating the sound. That is a different thing from acting as a tympanum; while Mr. Cooke regarded the mouthpiece as superfluous, because he had made repeated experiments which satisfied him of that, and that the instrument worked perfectly well without it. Here is the Gower-Bell which has no mouthpiece at all, and I am told that that is the latest improvement of the machine. There is one in Messrs. Boyd, Macdonald, and Lowson's office which has no mouthpiece at all, and they are told that it is the latest improvement. That is a matter of little importance, because

the mouthpiece is not the question in this case. That being all I have to say upon the infringement, let me say a word about the disconformity between the provisional and the final specifications. The latter has been quite fairly stated, I think, by my learned friend. In the provisional specification a patentee only requires to disclose the nature of the invention. He must not specify it in detail; but he must not, when he comes to specify six months afterwards, introduce into his specification any new or different invention from that which he has given, for this reason, that his protection dates back from the first, and if he did he might be getting protection for a new invention six months before he was entitled to it, therefore the law is very jealous in making this provision. That is what I think Mr. Edison did here. There had been a desideratum in telephones—a desideratum of a recording instrument. It was thought all very well to transmit speech, but it was also thought that it might be sometimes desirable to preserve a record of the speech in some form or other. Now, the kind of recording Edison had in view, and the final specification brings it out quite well, was not one for the reproduction of sounds at all, but the recording of lines and dots, and so on, which might be possible and in some manner proportional to the vibrations, and which might be read. The reading was another matter, but instruments had been devised before this for recording pure and simple, for marking upon some paper, or otherwise, dots or lines corresponding to the vibrations, undulating curves, and so on, such as, for instance, the syphon recorder of Sir W. Thomson. Thus a recording instrument was a well-known instrument apart altogether from reproduction. It was the phonograph and first brought in vocal reproduction of the sounds. Now, Edison in his provisional specification, as I read it, had the idea in his mind of rivalling those of Barlow and Scott, who had each produced recorders of a different and improved description. He, I take it, had no idea whatever of using that recorder as a means of reproducing vocally the sounds which it represented. It might be used by a reading of it with the eye, but not otherwise; and, accordingly, he indicated that some portions of his improvement could be availed of to make a record of the sound waves—some record of undulations which might, or might not, be available or capable of being read, but which were there. Then, he says: "portions of the apparatus are interchangeably available in transmitting or recording." It is on that passage, I understand, my friend finds. I do not know that you can read that. It is as plain as a pike-staff that receiving is the word meant, and if you read the text you will come to that conclusion. But taking it as it is printed, my lord, that is not the description of the phonograph as set out in the final specification. There is no portion of the instrument—the phonograph patented by Edison—which is interchangeably available for transmitting or recording. You have an instrument which is available for recording, and which may also be made available for speaking to the transmitter, but the transmitter employed is just the original transmitter, and the portion of the instrument used for recording is in no sense used for transmitting. It is the needle which establishes connection with the transmitter and other parts, in other parts of the patent, and of my friends' appeal to that argument, I answer that it does not help them in the least, because it does not allude to the phonograph as finally described. Not a word is said about reproduction, at all events vocal reproduction, although vocal reproduction is the one thing which has made the phonograph the celebrated discovery it has been. And if there were any doubt about the final specification, I take it that the terms of the title are conclusive as to what Edison meant. The title is not one that covers the phonograph, as that instrument is constructed, or any phonograph that has been invented. The phonograph is not the instrument primarily, or at all for transmitting sounds to a distance. It is an instrument for recording sounds when brought in by other instruments, and then reproducing them at the place. You may use other instruments to do it, but it is not the phonograph that does that. It is the other instruments that do that; and really to say that the phonograph is covered by such a thing as this is to stretch language in a way it was never stretched before. Edison had no idea of the phonograph when he made this specification. He had the idea of the recording instrument, and having made the discovery in the interval, he attempted the piece of sharp practice, not at all uncommon among other patentees, of adding and throwing in an additional invention he had made during the six months, so as to obtain protection for it. The phonograph, when it speaks, does so without the aid of electricity at all; but when the sound thus spoken is to be sent to a distance, which requires electricity, through another instrument—in fact, it requires a transmitter. You do not require a wire at all; and if you wish to transmit it to another place, you must make it speak in the way the human voice would speak. The phonograph is described as an instrument for recording sounds, and as self-speaking at the place where it stands; and although it may be that that same instrument may take the place of the human voice and speak to a transmitter, you have not got it thereby acting as a transmitter. I am not acting as a transmitter, because I speak to a transmitter. Well, in the same way a phonograph is not a transmitter, because the voice it utters is by another instrument conveyed to another place. The transmitter, the receiver, and the phonograph are all independent instruments. You may have a transmitter, a receiver, and a phonograph, and you may have another transmitter for transmitting the sound to another place, but these are all independent instruments, and the phonograph only takes the place of the individual who receives the sound, and who may keep it either to himself or tell it to some other body.

LORD M'LAREN: The action of the instrument is reversed.

MR. MACKINTOSH: As I understand it, the diaphragm speaks by inverting the action of the instrument used in recording, and which may be used for the purpose of speaking to a transmitter. But the diaphragm does not itself transmit.

LORD M'LAREN: Interchangeable action is not a very happy term in connection with transmitting and recording.

MR. MACKINTOSH: I am told that by reversing the instrument you may make it transmit the sounds it utters, but in order to do that you have to put on one of the electric tension regulators to the one end of the diaphragm, and thereby turn the instrument really into an instrument of a different kind altogether. It is not one portion that may be interchangeably used for transmitting and receiving. It is by adding something, but it is not the phonograph that transmits; it is a certain portion of the phonograph added to what is really part of the receiver—added to an important part of the instrument, the electric tension regulator. The description is very complicated, and I do not think the evidence on the other side has tended very much to clear the matter up; but I think it is so far clear that while the instrument may be used as a transmitter when something else is added to it, it may be used as a receiver of the sound, and then be used to give out these sounds again to the atmosphere. Now, with regard to Bell, the point there is a very narrow one. The question is whether Mr. Morgan-Brown was the first person to bring Bell's receiver to this country. There is no question with Bell. Mr. Morgan-Brown, being a person who got the information somehow, publishes it in this country, and the question is whether it was not published in this country before we say it was disclosed in September, 1876, and sufficiently disclosed, my friends say, in December, 1876. Now, in order to see whether there was disclosure of this invention in September, 1876, let me first ask your lordship to consider what the principle of the invention is to which this question relates. I am not impugning the Morgan-Brown patent upon either of its fifth plans. I am not attacking these, and I should add that these are the modifications of the Bell transmitter which are really of practical advantage. It is the two modifications of the fifth plan which are in practical use, and which have been improved up to the point of practical use. The permanent magnet is the one, and the electro-magnet with the battery in the line and the local battery, is the other. I am not taking these. The modification I am taking is the modification described in the fourth plan, which cannot be said to be successful, but which is claimed nevertheless, and it consists in modifications, first, of an electrio-magnet; second, a metal disc attracted by the magnet when charged; and, third, a battery in the line. These are the three features, and I am far from saying that that is a particularly useful invention, and that it works well, or will ever work well, nor that it is so useless as to bar a patent for utility. But it is no objection to advance that the instruments I found on do not work well, because there is no evidence that this instrument works well. Yet Mr. Morgan-Brown has claimed it, and the question is whether there was a disclosure prior to December, 1876, of this imperfect instrument. Now let us see what the novelty of this invention is as claimed in the specification. It consists of what I may say is an improvement—namely, the substitution of a metal disc for the membrane disc, which had previously existed in Graham Bell's previous receiver, and which was disclaimed in that Morgan-Brown patent; there was an instrument used as a receiver which had an electro-magnet, a battery in the line, and which had, beside the electro-magnet, and directed by it and vibrating in connection with it, a membrane disc. With these three things before 1876, before Morgan-Brown's patent was ever heard of—and that is conceded, and appears on the face of Morgan-Brown's patent—I pray your lordship to note that the only invention which is claimed under the fourth plan is an improvement on what I may call the membrane telephone, the improvement consisting simply in the substitution for the membrane disc of an iron disc fastened round its periphery by a certain system of wooden nippers.

(*To be continued in our next.*)

NOTES.

THE UNITED TELEPHONE COMPANY *v.* THEILER AND SONS.—On Thursday, the 16th inst., at the High Court of Justice, Chancery Division, before Mr. Justice Fry, Mr. Aston, Q.C., with Mr. Russell Roberts, appeared in support of a motion for an interim injunction to restrain the defendants from infringing the "Edison Transmitter." Mr. M. Cookson, Q.C., for the defendants, desired if the interlocutory motion were pressed, that his clients should have an opportunity of answering the expert evidence filed on behalf of the plaintiffs; but suggested that the motion should stand till the hearing, Messrs. Theiler in the meantime undertaking to keep an account. Mr. Aston did not accept the suggestion, and Mr. Justice Fry ordered the motion to stand over for a fortnight.

THE MAXIM ELECTRIC LIGHT.—The electric lighting of the Post-office at Philadelphia has been perfected by the addition of sixty Maxim incandescent lamps, which are used in the private offices and behind distributing tables that are in the shadow of the more powerful lights suspended from the ceiling. They were used on the evening of the 24th ultimo for the first time, and their illuminating qualities gave satisfaction to the employés.—*The Operator.*

MICROPHONE TRANSMITTERS.—On January 12th, 1878, which was three months before Mr. Hughes published his investigations on the microphone contact, Dr. Lüdtje, in Germany, obtained a patent covering broadly the trans-

mission of articulate sound by the action of a loose contact between two electrodes. The Bell Telephone Company, of Europe, subsequently acquired this patent, and commenced bringing suits against all who sold or used battery transmitters in Germany. Among those molested were Mr. F. Uppenborn, editor of the *Zeitschrift*, and J. Berliner, both of Hanover, Germany. These gentlemen, after repeated endeavours to convince the International Company that the Lüdtje patent could be overthrown by prior publications of Edison and E. Berliner in this country, appealed to the German patent office for a decision, and in consequence this department has just modified the Lüdtje patent, so that it is practically *hors de combat*, and since Mr. E. Berliner omitted, at the time of his invention, to apply for a patent in Germany, the use and sale of transmitters has become free from interference by monopolies. Thanks to Messrs. Uppenborn and Berliner.—*The Operator*.

ELECTRIC LIGHTING AT THE BIRMINGHAM MUSICAL FESTIVAL.—Amongst other arrangements for the Birmingham Musical Festival, the lighting of the Town Hall by electricity is contemplated.

THE JOEL LAMP.—We hear there are now being completed twenty-four Joel lamps for the Admiralty. There has been of late a considerable demand for these lamps, and those intended for the Pompeian Court of the Crystal Palace Exhibition are necessarily rather delayed.

ELECTRIC LIGHT AT NEW SOUTHGATE.—We are informed that a syndicate has been formed for the purpose of lighting New Southgate (near the Alexandra Palace) with the Pilsen system. One lamp has already been placed opposite the Railway Hotel for showing practically its efficacy in every respect for street lighting, and the experiment has up to the present been quite successful in spite of heavy winds and rains. We also hear that the Luton Exhibition is to be illuminated by means of the same system.

ELECTRIC LIGHTING NEAR STOKE-UPON-TRENT.—Some interesting electric lighting experiments have taken place at Trentham Hall, the Staffordshire seat of the Duke of Sutherland. The drawing-room has been very successfully illuminated, as well as the principal staircase and conservatory.

ELECTRIC LIGHTING.—In the House of Commons on Monday last, Sir J. M'Garel-Hogg asked the President of the Board of Trade whether his attention had been called to the various Bills with reference to electric lighting promoted in the present Session, and to the powers sought to be obtained, more especially as regarded controlling authorities, charges, profits, and interference with public thoroughfares; and whether he had any objection to state what course Her Majesty's Government proposed to take with regard to such Bills.

Mr. Chamberlain said his attention had been called to the Bills referred to; and he had been in communication with Lord Redesdale, the Chairman of Committees, on the subject. He hoped to introduce a public Bill shortly dealing with the whole question, and laying down the conditions under which, in the opinion of the Government, such Bills might proceed. He hoped the Bill would be sent to a joint committee of both Houses, or to a hybrid committee, and that all private Bills on the subject would be sent to the same committee.

DANGERS IN ELECTRIC LIGHTING.—According to the *Scientific American*, the Boston Manufacturers' Mutual Fire Insurance Company is engaged in making a thorough investigation as to the alleged dangers which may occur from the electric light. The danger from the arc lamp itself is shown to be easily provided for, and that of contact with telegraph, telephone, or electric clock wires, are too obvious and well known to call for further warning, and are all readily guarded against. The point most considered is that of a sudden rupture of the leading wires from any cause whatever, whereby the voltaic arc is extended while the ends are separating, to a considerable distance; and if in such a distance the current should pass through or come in contact with any combustible material fire would instantly occur. The report finishes by stating that "we have not yet found any cause of danger of fire from the use of the electric method of lighting which may not be avoided, if the right method and proper care be used in putting up and operating the apparatus." . . . "We may add one word of caution. Our members should be careful with whom they deal, and be perfectly sure not only of good and safe work, but also of the responsibility of the contracting parties, both with respect to the character of the work and of immunity from loss, in view of the fact that the whole subject may be said to be shingled over with patents."

ELECTRIC LIGHT VERSUS GAS.—At the recent half-yearly general meeting of the Gas Light and Coke Company the shareholders were asked "to disabuse their minds of any idea they might have had that the electric light had in any way caused the slight decrease in their revenue. On the contrary, it was stated that the electric light had added considerably to their rental. The diminution they had experienced was owing to the mild weather, and the reduction they had made of 2d. per 1,000 cubic feet, which meant a gain to the public of over £50,000. They had not, however, lost this amount, but only about £14,000, the increased consumption having made good the balance. The electric light had, in fact, created a demand for better gaslight, but they had nothing to fear from the former, as to the cost of which no information could be obtained." It appears to us that the electric light had everything to do with the slight decrease in the Gas Light and Coke Company's present revenue. The reduction of 2d. per 1,000 cubic feet, and the consequent amount saved to the public, is solely due to the influence of competition by electric lighting. That the company will suffer no loss in the long run, but rather benefit by this competition, we believe, for the consumption of gas both for lighting and other purposes will undoubtedly increase enormously, and will compensate for even a larger reduction than that now made.

PROFESSOR SILVANUS THOMPSON'S LECTURES AT THE CRYSTAL PALACE INTERNATIONAL ELECTRIC EXHIBITION.—In consequence of the great desire manifested by many residents in the neighbourhood, and by visitors, that a course of elementary lectures on electricity, with special reference to electric lighting should be organised, Professor S. Thompson, of University College, Bristol, will give the following course of lectures:—1. "Electric currents—What are they?" February 22nd. 2. "Electric currents—How to make them by Steam," March 1st. 3. "Electric arc lights," March 8th. 4. "Electric incandescent lamps," March 15th. They will be delivered in the Palace on Wednesday evenings, February 22nd, March 1st, 8th, and 15th, at eight p.m. The lectures will be illustrated by diagrams in the magic lantern, by experiments on the large scale, and by experiments in the magic lantern. Price of tickets: Single tickets, 3s. 6d. For the course of four lectures, transferable ticket for numbered seat, 10s. 6d. Admission to the room, 1s. Other lectures on the various systems of electric lighting are being arranged.

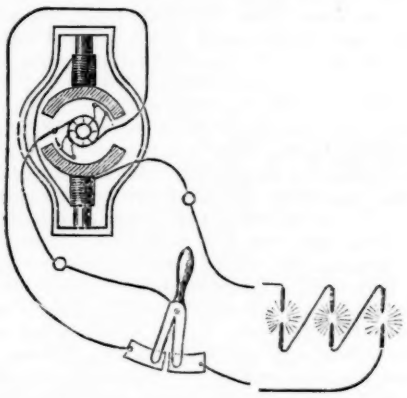
SUBMARINE TELEGRAPHS.—The Submarine Telegraph Company's cable steamer, the *Lady Carmichael*, returned at the end of last week to Dover, from a two months' voyage in the North Sea. The vessel left Dover on the 28th of December to repair four cables which were broken during the gales of last autumn. The work has now been effectually accomplished, and would have been done much sooner but for the inconvenience occasioned by the large fishing fleet engaged in the North Sea at this time of the year. A new single wire cable is about to be laid from Germany *viâ* the North Sea, the English Channel, and the Irish Sea, to Ireland, in order to obtain direct communication between Germany and America. The North German cable crossing from Lowestoft to Germany, which was broken last autumn, is not yet repaired.

THE SHETLAND TELEGRAPH.—It was ascertained yesterday that the break in the Shetland telegraph cable, which took place during the thunderstorm on Tuesday morning, is in Stronway Firth, where the ocean current between the

Atlantic and German Oceans runs swiftly between the islands of Stronsay and Shapinshay, in Orkney. The steamer *Morna*, chartered by the Telegraph Department, arrived in Orkney last week to lay a new shore end for the Pentland Firth cable, but can get nothing done owing to the stormy weather. It is expected she will also have to lift the Stronsay cable before communication with Shetland can be restored. There was a terrific westerly gale yesterday.—*Glasgow Herald*, Feb. 17th, 1882.

SHORT-CIRCUITING SWITCH FOR DYNAMO-ELECTRIC MACHINES.—Patent No. 252,663, filed in the United States of America Patent Office, Nov. 7th, 1881.

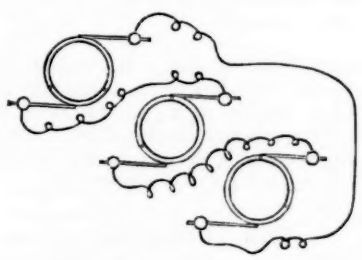
Brief.—A switch is arranged to close a short circuit around the field-magnets before breaking the main circuit, thereby weakening the field-magnets and preventing excessive sparking from the extra current.



Claim.—The combination, with a dynamo-electric machine, of a switch for making and breaking the main line connection with the machine and circuit-connections to said switch, as described, whereby a short circuit around the field-of-force magnets is formed before the main-line connection is broken.

COMMUTATOR FOR DYNAMO MACHINES.—Patent No. 252,405, filed in United States of America Patent Office, April 2nd, 1881. *Brief.*—The rings are formed of two sections or plates, to which the ends of the armature-coils are connected, one of the plates extending more than half-way around the commutator, whereby the armature-coil connected with each ring, is short-circuited while passing the neutral point. As a modification, the plates are made of equal length and the brushes so arranged as to be in contact with a single plate during a portion of the revolution for the same purpose :—

Claim.—1. The combination, in a dynamo or magneto-electric machine, with the revolving armature and two or more coils wound thereon, of brushes adapted to connect the same in series, and plates forming the rings of a commutator, constructed or placed, as described, to form



through any given ring a metallic connection between the brushes of the coil belonging thereto at times when the said coil is passing the neutral points, as described.

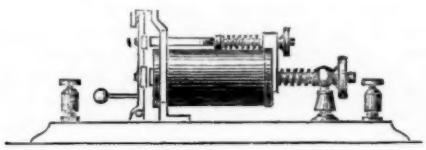
2. A commutator-ring composed of two segments to which the two ends of an armature-coil are connected, one or both of said segments being so formed as to extend more than one-half way around the said ring, substantially as and for the purpose set forth.

3. A commutator composed of a ring or a series of rings, each of which is divided into two segments, to which segments or pair of segments the opposite ends of armature-coils are connected, in combination with commutator-brushes, the relative arrangement of the said segments and brushes being such that both brushes belonging to each ring will be in contact with a single segment while the armature-coil belonging to such ring is passing the neutral points of its revolution, substantially as and for the purpose set forth.

4. In a dynamo-electric machine, two or more pairs of collecting-brushes, in combination with commutator-rings, each composed of two insulated metallic segments connecting with separate coils on the armature, and one or both of the segments of each pair being formed to extend to more than one-half way around the circumference of the ring, substantially as and for the purpose set forth.

TELEGRAPHIC SOUNDER.—Patent No. 252,497, filed in United States of America Patent Office, Nov. 17th, 1881.

Claim.—1. A telegraphic sounder in which an electro-magnet is combined with an armature-lever and stops, and

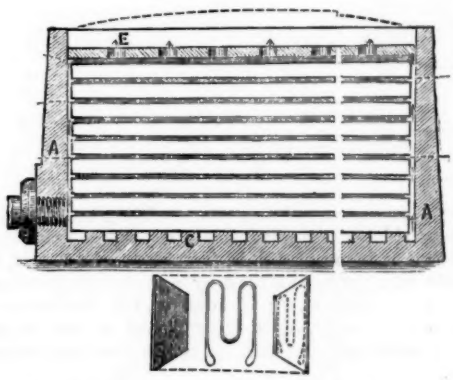


an adjustable permanent magnet adapted to act on and attract the armature-lever with and in the same direction as the electro-magnet.

2. The combination of the electro-magnet with an armature-lever having two armatures, a non-adjustable retractor, and an adjustable permanent magnet on the same side of the armature as the electro-magnet, all substantially as set forth.

PROCESS OF MANUFACTURING CARBONS.—Patent 252,386, filed in United States of America Patent Offi Feb. 19th, 1881.

Claim.—1. The process of carbonising shapes or blanks of carbonisable material, substantially as described, which consists in subjecting the same to a high temperature while inclosed in envelopes or between sheets of cardboard or



equivalent material whose rate of expansion and contraction is the same, or approximately the same, as their own.

2. The process of carbonising shapes or blanks of fibrous or textile material under pressure and between sheets or envelopes of cardboard or equivalent material whose rate of expansion and contraction when exposed to heat is the same, or approximately the same, as their own.

COUNTING ELECTRICALLY THE STROKES OF A STEAM HAMMER.—Some years ago, Mr. Coleman Sellers, of Philadelphia, noted the difficulty of counting the blows of a quickly-striking steam hammer when the strokes were near 300 per minute, a very wide discrepancy always occurring between the figures of those who attempted to count them, the tendency being to over-count rather than under-count. He found that three careful observers, counting the blows

at the same time, made a variation of from 275 to 285 in the same count. This wide discrepancy caused him to devise the following simple and ingenious method of making an accurate and automatic register of the strokes. He connected a recording telegraph instrument to the machine, placing two keys in the circuit. One key was closed by each blow of the hammer, a wire from this being attached to a rock shift in the valve motions, the other key being closed by hand. When the hand key was closed, dots were recorded on the paper ribbon—one dot to each blow of the hammer; and by keeping the hand key closed for a definite time—say, one or two minutes—a row of dots, representing the number of blows made in that time, were recorded, which dots could be counted afterwards at leisure. Many experiments have been tried with this apparatus attached, and it has been found that very seldom the count of any observer tallies with the count of the instrument, the rule being, as above stated, that the observer almost invariably over-counts. —*The Engineering and Mining Journal, U.S.A.*

EXPERIMENTAL PROOF THAT THE RESISTANCE OF GAS CARBON IS NOT VARIED BY PRESSURE.—During the recent telephone case the following experiment by Mr. Conrad Cooke was given in evidence to prove that there are no appreciable variations of resistance under variations of compression of the substance gas carbon, as is claimed for plumbago in Edison's patent, No. 2,909, page 7, line 22, and that the action of the microphone is due chiefly to variation of resistance at the joint, and not to variation of compression throughout the mass.

FIG. 1.

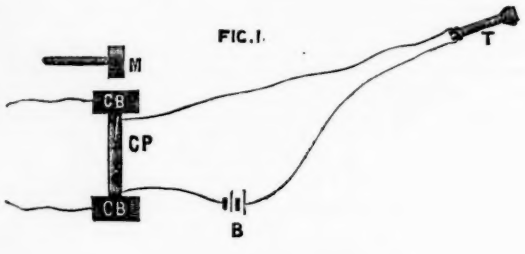
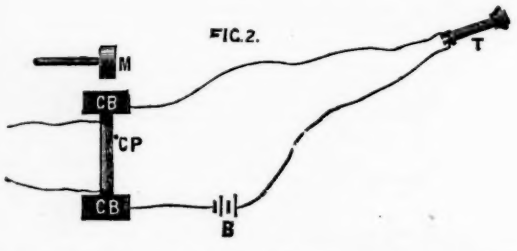


FIG. 2.



In fig. 1 we have a rod or pencil of gas carbon, C P, placed between two blocks of similar carbon, C B, C B, a telephone, T, and battery, B, being placed in the circuit of C P. If, now, the upper block, C B, be struck by a mallet, M, no sound is heard in the telephone, T; if, however, the arrangement is that shown by fig. 2, then every stroke of the mallet is distinctly heard, proving that the action is at the surface of contact.

MINERALS, CHEMICALS, &C.—We extract the following from George G. Blackwell's recent report:—Minerals: Sulphate of iron—selected lumps, 40s. to 42s. 6d.; first-class, 25s.; good, 17s. 6d.; prime white ground, 87s. 6d.; first quality, 72s. 6d.; seconds, 52s. 6d. to 55s.; common, 45s. China clay: best, 42s. 6d.; good, 35s.; fair, 22s. 6d. Emerystone, £6 to £6 5s. French chalk: our arrivals this week are only 200 bags, and price is still firm, £6 10s. Asbestos: floss, £23; Canadian rock, £35; and common, £18. Phosphate of lime, 1s. 4d. to 1s. 5d. per unit. Tungsten metal, 3s. 6d. per lb. Manganese ore steady. Ferro-manganese: 50 per cent., £13; 70 per cent., £21. Antimony ore, £16 10s.; crude, £23 10s. Plumbago: best, £18; and good, £8. Resin: good medium, £7 10s. Chemicals: soda ash, 1⅜d.; caustic soda, 60 per cent. white, £8 12s. 6d. to £8 15s.; cream, £8 10s. to £8 12s. 6d.; 70 per cent. white, £9 15s. to £10; bicarbonate, £8 15s. to £8 17s. 6d. Chlorate of potash, 6d. Bichromate, 6d. Soda crystals, 65s. to 70s. Alum: lump, £6 15s.: ground, £7 15s. Alum cake, £3 17s. 6d. to £4. Saltpetre: crystals, £31; ground, £32. Sulphur: roll, £8 15s. to £8 17s. 6d.; flour, £11 10s. Sulphate of copper, £23. Metallic sodium, 7s. 6d. per lb. Chloride of calcium, 57s. 6d. Metallic cadmium, 7s. 9d. per lb. Chlorate of soda, 1s. 6d. per lb. Tungstate of soda at 90s Carbonate of magnesia, 52s. 6d. Manganese: Sulphate, £21. Borate, 10d. to 1s. per lb. Chloride, £24. Nickel salts, 2s. per lb. Salammoniac: best, 50s.; seconds, 45s. Muriate of ammonia: white, 35s.; gray, 32s. 6d. Sulphate of alumina, £5. Hydrate of alumina, £19. Nitrate of soda, 15s. 6d. Shellac; best orange, £10; good, £8 10s.; carbonate of potash, 29s.

HONOURS FOR TELEGRAPHIC SERVICES.—We notice in the *Journal Officiel*, dated Paris, 13th February, that M. François Emmanuel Jules Raynaud, D.Sc., ingénieur de télégraphes, has been promoted to the grade of Officier de la Légion d'honneur. M. Raynaud, who was a member of the commission on electrical units at the Paris Exhibition of Electricity, has written several treatises on electrical subjects, and is one of the editors of the *Annales Télégraphiques*. Aided by others, he translated into French the work by Mr. J. E. H. Gordon, "A Physical Treatise on Electricity and Magnetism," correcting several of the errors which generally appear in the first edition of a work of this class. As many of those who met him at the exhibition must be aware, M. Raynaud combines a theoretical with a thoroughly practical knowledge. He re-established telegraphic communication during the Franco-German war, whilst standing in the river up to the waist in water, by making a gutta-percha joint, being only shielded from the vigilant eyes of the German sentries by an arch of the bridge under which he was working. For this and other services he was made Chevalier de la Légion d'honneur, on the 8th Dec., 1870.

THE BRITISH ASSOCIATION.—The executive committee for carrying out the arrangements of the annual meeting of the British Association, to be held at Southampton in August next, met at the municipal offices last week, the Mayor (Mr. W. H. Davis) in the chair. It was officially reported that his Royal Highness Prince Leopold had accepted the presidency of the local executive committee, and was expected to be present at the meetings in August. The vice-presidents already named and accepted are the Bishop of Winchester, the Earl of Carnarvon, the Earl of Northbrook, the Hon. Evelyn Ashley, M.P., Mr. H. Lee, M.P., Mr. W. W. B. Beach, M.P., Mr. Sclater-Booth, M.P., Mr. C. Garnier, M.P., Mr. R. Moss, M.P., Mr. J. D. Lewis, J.P., Professor Maclean, C.B., Mr. E. N. Hulse, Mr. Montefiore, the Rev. Canon Basil Wilberforce, the Mayor of Winchester, the Hon. Gerald Lascelles, Mr. Sartoris, Sir Charles Pearson, V.C., Mr. S. Macnaghten, J.P., and Dr. Ridding. Professor Bonney, of the British Association staff, had been to Southampton, and, having visited the buildings proposed to be engaged, expressed his entire satisfaction with the arrangements so far made. The guarantee fund now amounts to about £1,100, and is constantly receiving accessions.

THE HUGHES TYPE-PRINTER.—We understand that the French government officials have been successful in applying the Hughes instrument to one of their Marseilles-Algiers cables. The speed attained is about 1,000 words per hour, and this, considering the lengths of the cables (about 500 nautical miles), is highly satisfactory.

NEW COMPANIES.

INSULITE COMPANY.—Offices: 18, King Street, E.C. Objects: To adopt an agreement made between J. A. Fleming and A. H. White of the one part, and W. C. Jackson, as trustee for the company, of the other, for the acquisition of letters-patent enjoyed by the former, for improvement in the preparation of materials to be employed for the purposes of electric insulation. Purchase consideration: £1,500 and one-half of the shares issued. Capital £20,000, in £10 shares. Signatories: E. Easton, Delanay

Street, W., 50 shares; Major-General Green, 93, Belgrave Road, W., 10; the Duke of Sutherland, St. James's, S.W., 20; General Kemball, 79, Queen's Gate, S.W., 10; J. A. Fleming, Nottingham, 1; T. White, 18, Church Row, Hampstead, 50; M. M. Moore, 83, Lombard Street, E.C., 50; W. C. Jackson, 18, King Street, E.C., 10. Directing qualification: The holding of 250 shares. Also directors: F. Walters, A. H. Huth, and A. H. White. Remuneration: £500 per annum, and 10 per cent. of all surplus after payment of ten per cent. dividend. Registered February 10th, 1882, by Messrs. Radcliffes, Cator, and Martineau, 20, Craven Street, W.C.

THE EASTBOURNE ELECTRIC LIGHT COMPANY (LIMITED).—Objects: To provide and supply light and heat by means of electricity, also power, &c., and to transact business of all kinds connected with electricity. Signatories: George Boulton, J. P. Langham, J. A. Skinner, Caleb Diplock, Henry Sutton, Alexander Hurst, William Routledge, all of Eastbourne. Capital £50,000 in 5,000 shares of £10 each. Registered February 15th.

THE RIVER PLATE TELEPHONE AND ELECTRIC LIGHT COMPANY (LIMITED).—Offices: 6, Lombard Street, E.C. Objects: To enter into an agreement with the Consolidated Telephone Construction and Maintenance Company, and to carry on the business of a telephone, telegraph, electric light, and power supply company. Directors: Julius Vogel, Frederic Allen Gower, P. Carnegy, Charles Curtoys, Theo. Daunton, Percy A. W. Dalton, T. L. Scott. Secretary: Chas. Curtoys, Esq. Capital £100,000, in 20,000 shares (16,000 preferred shares, and 4,000 deferred shares) of £5 each.

THE FAURE ELECTRIC ACCUMULATOR COMPANY (LIMITED).—Objects: To enter into an agreement between John Henry Johnson, of 47, Lincoln's Inn Fields, of the first part, Camille Alphonse Faure, of the City of Paris, of the second part, La Force et la Lumière (Société Anonyme) of the third part, and John Wiseman, 12, Tressillian Road, New Cross, on behalf of the company, for the sole and exclusive privilege of using, vending, &c., M. Faure's patents for improvements in galvanic polarisation batteries or magazines of electricity, and to carry on all kinds of business connected with electricity. Signatories: Arthur Otway, M.P., C. Seymour Grenfell, Harvey Ranking, Samuel Mendel, Charles Clifford, Emmanuel Horace Cadit, Robert Charles Tucker. Capital:—£1,000,000 in 80,000 shares of £10 each, and 200,000 deferred shares of £1 each. Registered 15th Feb.

CORRESPONDENCE.

HUGHES' MICROPHONE *v.* EDISON'S TRANSMITTER.

To the Editor of THE ELECTRICAL REVIEW.

SIR,—When, some three years ago, Professor Hughes published to the world his wonderful invention of the microphone, and disdained to make any money by it, he became the scientific lion of the period. He was made a Fellow of the Royal Society in recognition of his discovery, and his name became as familiar as a household word throughout the educated world.

And now, when his invention is bearing fruit, and is finding an immense application daily increasing, the disinterested savant is quietly taken down from his pedestal, and the laurels torn from him by hands thought incapable of such work. The microphone is declared to be an infringement of Edison's patent!

Is it possible that no voice will be lifted in angry protest against such flagrant injustice?

I ask you, sir, to stir your readers into action, to lend your aid to, or devise some plan by which every independent electrician may have an opportunity of declaring Professor Hughes to be the true and first inventor of the microphone. I feel confident that hundreds of English and foreign electricians will be glad to give expression to such a declaration, if an opportunity is afforded them.

I am, Sir, yours truly,

HONORIS CAUSA.

THE TELEPHONE CASE.

To the Editor of THE ELECTRICAL REVIEW.

SIR,—Your leader on the recent Telephone Suit at Edinburgh expresses exactly my own opinion, and no doubt the opinion of the great majority of your readers. But I find that your comments are directed entirely upon the question of the validity of Bell's patent, and that you do not even allude to the remarkable evidence given on the microphone question. Now nobody seems to deny that the telephone receivers used by the defendant are the invention of Graham Bell, and it is perhaps only natural that the proprietors of Bell's patent should do all they can when their exclusive proprietorship is endangered. But surely no electrician who has made himself familiar with the microphone, no one with only an elementary knowledge of physics, will say that Hughes' microphone was anticipated and described in Edison's patent of July, 1877! It might be asserted with equal accuracy and justice that Leclanché's battery was anticipated and described by Bunsen, because both use zinc and carbon; or that Siemens' dynamo machine is an infringement of Gramme's, because in both a conductor is made to revolve in a magnetic field; or that Morse's very first telegraph described and enabled any one to make a Thomson recorder, because in that instrument an electro-magnet was caused to write a zigzag line upon a ribbon of paper. Nobody has yet made any such absurd assertion; but to maintain that all telephone receivers are infringements of Bell's patent if they have a magnet, and all transmitters infringements of Edison's patent if they have carbon in them, is, to say the least of it, equally absurd.

It must be patent to every peruser of Edison's specification of the date mentioned, that the invention only consists in a certain method of compressing *elastic* conductors. Edison evidently never thought it possible that much better results could be obtained by using perfectly *hard, incompressible* conductors, because he considered it necessary that one of them should be a fixture. He could not substitute a block of *hard* graphite for his *elastic* lampblack button, because it would be utterly impossible to adjust the pressure of the diaphragm against the block, and to keep that adjustment for a single minute. The action of the microphone is not yet satisfactorily explained, but that the effect obtained is not due to the compression of the carbon pencils can be easily demonstrated. If the contacts of a Theiler transmitter, or any other suitable microphone, are coated with the thinnest possible film of platinum or gold, the apparatus ceases to transmit articulate speech. Why should it do so? The carbon pencils are still there; the same variation of pressure is exerted upon them as before. Does not this experiment prove clearly that the action of the microphone takes place at the points of contact *only?* The structure of the conductors is, however, not the only or even the principal difference between Edison's and Hughes' inventions. The superior, wonderful results obtained by the microphone are mainly due to the circumstance that the vibrations of the sounding board, or diaphragm, are not impeded by a fixed contact as in the Edison transmitter, but are allowed to assume any amplitude, all the parts vibrating together, but at *different velocities*. Herein lies the great originality of Hughes' splendid invention. This difference of velocity in the vibrating parts could, however, not be obtained if a spring was substituted for the free weight. The merest tyro in mechanics knows that a spring *cannot* act in the same way as weight, and *vice versâ;* and it seems to me most extraordinary that eminent professors of physics should contradict their own teaching and the laws of their science by asserting that the free weight in a microphone performs the same function as a spring. Substitute a spring for the weight in any form of microphone, and the microphone is destroyed.

I trust that an abler pen than mine will come to the rescue of Professor Hughes' beautiful and valuable invention, and that it will be saved from the jaws of the rapacious Edison patents.

I am, Sir, yours truly,

RIGHT *v.* MIGHT.

To the Editor of THE ELECTRICAL REVIEW.

SIR,—In my letter of 14th inst. I expressed an intention to address you on the subject of Edison's patents, and I now attempt to fulfil that rash promise, for I find I have promised to do that which I fear I will not be able to accomplish in a manner worthy of your review, because the Scotch mist which envelopes this part of the case is so dense that I find it difficult in the extreme to unravel the casuistry of the witnesses, counsel, and presiding judge. I however make an attempt to bring out in relief such facts as seem to me to be established.

The first witness for the complainers, Sir Frederick Joseph Bramwell, said, "In my judgment that apparatus (Theiler's) comprehends the novel and essential features of Edison's electric tension regulator." "I think it is entirely within the claim of Edison." These are his opinions, but I fail to find any description of Edison's tension regulators given by Sir Frederick, or in Edison's patent, in support of his opinion. Now, in a court of justice opinions are not accepted as facts; a witness may have an opinion about the existence of a thing, may conscientiously believe his opinion to be correct; but opinions are not proofs, therefore Sir Frederick's opinion does not establish the fact that Theiler's apparatus is within the description and claims of Edison.

In reply to the question put by the counsel for the respondent, "Does Mr. Edison include in his claims all the forms of electric tension regulators?" Sir Frederick said, "No; only those that he has described." Now, here is a positive assertion, not an opinion, of Sir Frederick. In subsequent statement Sir Frederick said: "Where a similar material is chosen and where you have a diaphragm producing pressure upon the electric tension regulator in a closed circuit then you have Edison's invention." Here comes in the Scotch mist. I ask for what purpose is the "similar material chosen." Is it for the diaphragm, or for the tension regulator? To me this is very ambiguous. It seems that this ambiguous language is for the purpose of qualifying the first statement of Sir Frederick—that the tension regulators must be those Edison had described.

A specimen of Professor Hughes' microphone, as described to the Royal Society in 1878, was shown to Sir Frederick, who, when pressed for his opinion, said, "he believed it did come within Edison's claim." As a commentary on this expression of belief by Sir Frederick, I quote from the inaugural address before the Society of Telegraph Engineers by Mr. William Henry Preece, President, Jan. 28th, 1880, the following: "The telephone has made but little progress during the past year, though there is no doubt that through the discovery of the principles of the microphone by Professor Hughes, the practical applications of that wonderful instrument have been much improved. In fact, Professor Graham Bell, Mr. Edison, Mr. Elisha Gray, and all those who have been working in this field, have laid aside their own particular form of transmitter and have adopted one that is a mere form of microphone." So much for Sir Frederick Joseph Bramwell.

Sir William Thomson, upon being shown Theiler's transmitter, said, "This is most distinctly Edison's carbon transmitter." In speaking of Professor Hughes' microphone Sir William said, "there is nothing in it which is not in Edison."

A great deal was said by Sir William about "looseness of contact" and "delicacy of contact" of the carbons. In his opinion there is "a virtue and a vice" in looseness of contact. He says Professor Hughes' microphone has delicacy of contact. I must confess that I do not appreciate the difference between "delicacy of contact" and "looseness of contact." And, further, Sir William said "it is essential to have a continuous variation of pressure and a continuous current;" "the jolting motion would be a make and break, and the articulate sound would be impaired." "My theory is that Theiler's transmitter works by simple variation of pressure, and I cannot conceive any other law in its action." "I think the elements which work advantageously in Professor Hughes' microphone would be detrimental to the good working of the articulating instrument." "I do not see any advantage in multiplying the carbons." To these opinions, or *dicta*, of Sir William, I invite attention, because they are not sustained by facts before the court. There was an instrument known as the cork transmitter on the microphone principle, being composed of two pieces of carbon lying separated from each other on a piece of cork, these two carbons being connected together by a third piece lying *loosely* on them, all covered by a thick piece of cork, and the articulation of sounds spoken to them when received on a Bell receiver is remarkably clear and distinct. Here was looseness of contact and no diaphragm.

Professor Fleeming Jenkin's principal remarks were, "he protested against the name 'tension regulator' as simply abominable," adding "that he did not consider Edison an authority on the *modus operandi*, and that his language throughout the letter-press was like his English—bad."

When asked if a particular form of tension regulator had been made, he said, "I have no knowledge on the subject, but all the instruments are essentially the same." This assertion of Professor Jenkin on a subject on which he says he has no knowledge, no doubt had great influence on the court!

On the microphone Professor Jenkin differs with Professor Thomson, for the former says, "I believe Hughes discovered the microphone." One of Mr. Edison's assistants was also examined on the part of the complainers, but his testimony amounts to nothing.

I now come to the testimony of the witnesses on the part of the respondent, the first of whom was Mr. Conrad Cooke. This witness said Edison's second claim in his second disclaimer claims "a combination of diaphragm-tympan and electric tension regulators as described in his specifications," and that "Theiler's instrument is a dissimilar instrument," and that he "does not find in it any of Edison's tension regulators." "The essential features of the tension regulators described by Edison appear to be all on one principle, depending more or less on the variation of the density," and "they proceed by compression of the substance and by varying the density of the substance." "Theiler's instrument is a form of Hughes' microphone described by Hughes." "That was regarded as a very important discovery by the scientific world." "It introduced quite a new principle into the construction of transmitters." "Before Professor Hughes introduced his microphone only the magneto, or Bell's form of telephone, had come into use in this country."

"The first and most striking principle of Hughes' microphone is a shaking and variable contact between the two parts constituting the microphone. That shaking and variable contact is produced by the movable part being affected by sounds. There are no mechanical means employed for producing that shaking or vibration."

This is no doubt an accurate statement of the action of Hughes' microphone. I fail to find any description of the various electric tension regulators described by any of the witnesses. Now, with due deference to all the parties to this case—judge, counsel, and witnesses—I suggest this omission to describe Edison's tension regulators seems unaccountable, unless it be for the reason that Edison's specification did not furnish sufficient data to enable any of the eminent men of science who gave testimony to describe them.

This witness also stated that "the tympanum is essentially part of Edison's system." Now permit me to say the word tympanum is incorrectly used—it should be tympan, because *tympanum*, according to Dr. Johnson, signifies "the drum of the ear," whereas *tympan* signifies a drum or timbal; and he further states that "articulate speech was conveyed by the microphone of Hughes without using diaphragms." Here we have the comparison of the words diaphragm and tympan, which are not synonymous, for diaphragm means "a partition which divides a hollow body," derived from two Greek words, Διὰ φραγμα; the form Διὰ meaning "through," "across," and φραγμα "that which is shut up or inclosed."

The Lord Advocate read the following extract from the specification of Edison:—"The first part of my invention relates to an improved method of constructing telephonic transmitters, in which the pressure of the two contacts against one another is made to vary by the vibrations of a diaphragm or sounding board." This is no doubt correct, and this description of its action is to be taken in connection with Edison's second claim, viz., "The combination with a diaphragm or tympan of electric tension regulator substantially as hereinbefore described." On examining every form

of this combination in Edison's specifications and drawings, it is evident that it is variable pressure of two parts of his tension regulators against one another—not a shaking and variable contact, as in Hughes' microphones, for in all Edison's tension regulators their several contact pieces are secured to separate and distinct materials, and it is by variable pressure of these materials against one another that Edison's apparatus works, whereas in Hughes' microphone all its parts are attached to the same material, and it is by shaking that material that the variable contacts are produced.

Theiler's instrument acts on this latter principle, all the parts of the microphone being attached to the same material. The results produced by the two methods may be the same, but there cannot be a doubt that the means used to produce those results are different. Edison's was pressure, Hughes' was shaking, and Hughes' method produces so much better results than those of Edison's that this latter method has been totally abandoned even by the owners of Edison's patent.

Two of the eminent witnesses have said that Edison invented the microphone, but I fail to see that either of them pointed out in Edison's specifications or drawings any device resembling even in a remote degree Hughes' microphone. Professor Blyth said, "that Theiler's instrument worked on the principle of Hughes' microphone, and not on the principle of Edison's instrument, where the variation of resistance of the tension regulator is produced solely by the pressure exerted upon it;" that the action of Hughes' microphone "de pends more or less upon the looseness of the contact," which "feature is purposely and intentionally guarded against in Edison's." This latter "aims at a contact as perfect as possible, whereas Hughes' microphone depends essentially upon the looseness or delicacy of contact."

This seems to be a true description of the two instruments, and of their principles of action.

The use of a diaphragm, I should say tympan, with *any kind* of tension regulator, seems, in the opinion of Lord M'Laren and of the Lord Advocate, to be within Edison's claim, as must be inferred from the following question put by Lord M'Laren to the Lord Advocate:—"I suppose if they (Theiler) dispensed with the diaphragm they would be without the patent, because the tension of the diaphragm is the material point." To this the Lord Advocate replied, "Yes." I have not time to waste upon the addresses of the Lord Advocate and of the counsel for the respondent, especially as your readers have them in full in your careful report of the case; and I will conclude this already too long letter by a few remarks on the decision rendered by Lord M'Laren.

"Edison's efforts were directed to the discovery of a method by which the means of sound should operate more powerfully on the electric current, and "this he effected by a process of varying the resistance in a closed circuit, which was accomplished by making a joint in the circuit near to the transmitter, so that the current should at this point pass from one surface to another in contact with it under pressure," and "the variations of pressure between the surfaces, consequent on the vibration of the tympan, induce variation in the electric current." Now, there we have *pressure* necessary in Edison's instrument, which witnesses have shown not to be necessary—in fact, not used—in Hughes' microphone as adopted by Theiler.

Lord M'Laren proceeds as follows:—

> Being satisfied that the respondent's instrument is an application of the principle of Edison's tension regulator, and that it involves the combination of a tension regulator with a tympanum, I have only to consider whether the instrument is itself distinct from anything described by Edison, or is an imitation or mechanical variation of his invention.
>
> In answering the question, it must be observed that Edison's patent is not for a specific instrument, but for a combination, in which the material element is an "electric tension regulator," of which many forms are given, all depending on a mode of action of great simplicity, and capable of being indefinitely varied. The mode of action I take to be this: The variation of the electric current by pressure applied to a carbon surface—not the constant pressure of a screw or spring, which is a mere accident of the arrangement—but the elastic pressure of the sound waves, which are made to operate upon the carbon through a tympanum. In such a case, it may well be said that the instrument admits of as many variations as there are modes of bringing two surfaces into contact. But however unlike any particular variation may be to those which are described in the specification, yet if the contact is that of a semi-conductor of electricity, and is used in a telephone for the purpose of varying the resistance to the electric current in the line, I am of opinion that it is a form of Mr. Edison's invention, and that the words of the specification are broad enough to cover it.

In the first part of this claim Lord M'Laren says Edison's patent "involves the combination of a tension regulator with a tympanum;" but he seems to have ignored the words of Edison's second claim, "*tension regulators substantially as heretofore described*," which seems to be an omission of a very important matter; for if this decision be correct, then Edison's claim covers every form or material of any tension regulator which may hereafter be discovered. This decision, however, must stand as law in Scotland, until it is reversed by a higher court, to which it is hoped this important matter may be submitted at an early day.

The decision is that in receivers used for the reception of sounds, Bell's claims cover "the combination with an electro-magnet of a plate of iron or steel, or other material, capable of inductive action, which can be thrown into vibration by the movement of surrounding air, or by the attraction of a magnet," and that Edison's claim covers all transmitters in which an "electric tension regulator" is used in combination with a diaphragm.

There cannot be any doubt as to the above claim of Morgan-Brown's patent, "so far as I know," will be a valid claim after a fiat shall have been granted to disclaim and amend the last disclaimer, but I think Lord M'Laren has erred in claiming for Edison's the use of *all kinds of tension regulators* in combination with a tympan.

I have read and re-read the entire report of this case, and I cannot refrain from expressing my opinion that the battle fought in Scotland was a sham battle, for this is the only reason I can find for the withholding from the court the publication of Bell's United States patent five months before his application for his English patent.

Yours,

London, *Feb. 21st*, 1882. W. C. BARNEY.

To the Editor of THE ELECTRICAL REVIEW.

SIR,—I regret exceedingly that you did not publish the full specifications and claims with all the drawings of M'Donough's patent, entitled "Telephone," filed in the United States Patent Office on the 10th April, 1876, which accompanied my letter to you—because the absence of these important particulars has led Count du Moncel into a grievous error in regard to the full scope of the claims of that patent—for I am sure had Count du Moncel read them he would not have expressed himself in the terms he used in the last paragraph of his article, "History of the discovery of the Telephone," published in *La Lumière Electrique* of the 4th inst. I have too much regard for the extensive research and almost universal scientific attainments of Count du Moncel to enter, for one moment, into a discussion with him on any scientific subject, and I must, therefore, earnestly beg of you to publish in full the specifications and drawings of M'Donough's patent, which I again send to you, so that Count du Moncel may be able to judge for himself as to the merits of this invention, and at the same time be able to compare the specifications of Professor Bell's United States patent, filed in the United States Patent Office on February 14th, 1876. The title to Bell's patent is "improvement in telegraphy;" and in his specifications Professor Bell describes his method of transmitting signals by means of "musical notes," but nowhere speaks of transmitting articulate speech. In fact, the instrument therein described does not transmit articulate speech. It was only after Bell had adapted the circular iron diaphragm to his instrument that articulate speech was produced, and the first evidence of the use of the circular iron diaphragm by Bell is his English patent of 9th December, 1876.

Far be it from my intention to attempt to deprive any one of his just rights, and, therefore, I sent to you the patent of M'Donough, and put the question "It may be asked to whom does the honour of the invention of the telephone belong?" An examination of M'Donough's patent for "telephone" clearly proves that on April 10th, 1876, he claimed "the art of transmitting articulate speech by electricity"; secondly, a variable resistance-contact transmitter for electro-speaking telephones; thirdly, a magneto-receiver for electro-speaking telephones.

M'Donough's specifications describe in a very lucid

manner a transmitter with a variable resistance-contact, and this appears to me to be a *microphone*, in fact, it is a microphone of a very simple form, and certainly it is the first description of a microphone of which we have the most reliable evidence, the certificate of the United States Patent Office, which no doubt will be conclusive evidence to Count du Moncel.

M'Donough's patent also describes a magneto-receiver. I invite special attention to the description and drawings of his magneto-receiver, and a comparison of it with that of Bell in his United States patent of January 15th, 1877. It would seem that one was the fac-simile of the other, and as M'Donough is the first one on record by nearly a year it would appear that M'Donough was the first inventor of a magneto-receiver—unless, indeed, he be guilty of a charge similar in nature to that made by the wolf against the lamb, of muddying the water up the stream.

I cannot but repeat my regret that Count du Moncel should have been led to express himself as he did upon my letter to you, and I am sure he will not delay to relieve me from the imputation that I have attempted to ruin a true inventor by giving publicity to pretensions which nothing justifies, and that an examination of the specification of M'Donough's patent, filed April 10th, 1876, will convince him that there is very strong grounds for believing, in fact, indisputable evidence, that M'Donough was not only the first inventor on record of a speaking telephone but also of a microphone.

Yours truly,

W. C. BARNEY.

London, *February 22nd*, 1882.

[As we desire to be quite impartial in all such matters as those treated in Major Barney's letter, we reprint at his request the principal portions of the M'Donough patent, filed in the United States Patent Office, April 10th, 1876, with remaining two drawings thereof, and also claim three with figure 5 from A. G. Bell's United States patent, No. 186,787, filed January 15th, 1877, dated January 30th, 1877.—ED. ELEC. REV.]

Be it known that I, James W. M'Donough, of the city of Chicago, in the county of Cook, State of Illinois, have invented a new and useful telephone, for which I made an application for patent April 10th, 1876; and I do hereby declare the following to be a full, clear, and exact description thereof, which will enable others skilled in the art to which my invention appertains to make and use the same, reference being had to the accompanying drawings.

The general object of my invention, as I have set forth in my original application and in other divisions thereof filed of even date with this division, is to provide a means for transmitting articulate sounds from one place to another through the medium of electricity.

* Fig. 1 represents a perspective view of a telephone receiving apparatus embodying my invention joined in circuit with my telephone

FIG.4

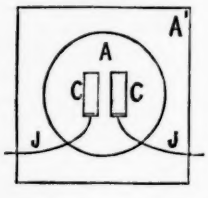
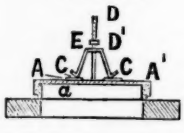


FIG.3.



transmitter. Fig. 2 represents a sectional plan of the same, taken on line, *x x*, drawn across fig. 1. Fig. 3 represents a vertical transverse section of the telephone transmitter, taken on line, *y y*; and fig. 4 represents a general plan or top view of the same.

Like letters of reference represent like parts.

In the drawings, A represents the transmitting membrane or apparatus, composed of vellum or any suitable material that is sensitive to the vibrations of sound, which is stretched upon a metal hoop or band, *a*, permanently attached to the bed, A', by angle-pieces, T, fig. 1.

C C are metal plates of German silver, or such like material, attached to the upper surface of the membrane, A, each side of its centre or point of greatest range of vibration, and insulated from each other.

D is a metal bolt permanently attached at its lower end to said membrane, A, centrally between plates, C C, and insulated from them.

D' is the circuit-controller, which consists of an arc-shaped piece of German silver or like material, loosely secured at its centre upon the bolt, D, and bent upward at each end from the membrane, A, as shown in fig. 3, so as to form depending V-shaped legs adapted to rest upon the respective plates, C C, and to make contact between part of their granular surfaces and the granular surfaces of the controller, in the manner set forth in the several divisions of my original application relating to the transmitter.

* For Figs. 1 and 2, see ELECTRICAL REVIEW, January 28, page 59.

F is the receiving or sounding membrane, which is also composed of vellum or any suitable material that is sensitive to the vibrations of sound, and is stretched upon a metal hoop or band, *a'*, secured to the side frame, G, of wood or such like insulating material, of the receiving or sounding apparatus, as shown in fig. 1.

G' is the magnet of a continuous piece of iron, surrounded by a helix of insulated wire, and connected to the instrument immediately in front of the membrane, F, and at a point near its centre.

H is a thin metal armature-plate permanently attached to and supported by the membrane, F, between it and the magnet, as shown in fig. 1, so that the membrane receives the exact and entire motion of its whole area.

E is a sound-recess in the frame or holder of the receiver, inclosed on its sides or circumference by the wood of the frame, G, and on the end near the magnet by the membrane, so that the sounds emitted by the armature and membrane may be confined and directed to the ear of the listener, while all exterior sounds are excluded.

To each of the plates, C C, is connected a wire, J, one of which is connected with the battery, K, and the other with the ground-wire, L. To each of the poles of the magnet is connected a wire, M, one of which is connected with the battery, K, and the other to the ground-wire, as shown in fig. 1, by means of connecting-screws, N N, mounted or fixed in the wooden frame at the same end with the magnet, and insulated therefrom and from one another by the material of the holder.

The operation of my telephone-receiving apparatus is as follows: The transmitting membrane being at rest, the circuit-controller rests upon the plates and completes the circuit of the electric battery through the helix of the receiving apparatus. The said membrane being sensitive to sound vibrations produced in its vicinity is made to vibrate thereby, and the flow of the electricity through the wires, and the helix is thereby controlled by the action of the circuit controller, D', resting upon the plates, C C. By these means the magnet, G', is caused to alternately attract and release the armature, H, causing it and the membrane, F, to vibrate in response to the action of the transmitter when affected by sound-waves or vibrations.

Claims: "A telephone-receiver consisting of the combination, in an electric circuit, of a magnet and a diaphragm, supported and arranged in close proximity thereto, whereby sounds thrown upon the line may be reproduced accurately as to pitch and quality, substantially in the manner hereinbefore set forth.

"The combination, substantially as hereinbefore set forth, of a transmitting-membrane composed of vellum or any suitable material that is sensitive to the vibrations of sound, and a piece or pieces of conducting material connected with the same, and receiving from it vibrations less in extent than its extreme range of vibration with a circuit-controller, which, when at rest, has points of contact with said conducting piece or pieces, making part of an electric circuit through them and the battery, and which receives from the membrane when in motion said reduced vibrations in accord with the waves of air producing sound, and thereby causes impulses in the electric current through the said conducting piece or pieces, all constructed and operating substantially in the manner described."

"The combination, substantially as hereinbefore set forth, of a transmitting membrane composed of vellum or any suitable material that is sensitive to the vibrations of sound, and a circuit-controller arranged to vibrate in connection with it, and a conducting piece or pieces, wires, and a battery with the magnet, helix, armature, and membrane of the receiving apparatus, whereby vibrations are caused in said armature and membrane by means of an electric current, substantially in the manner and for the purposes set forth."

"Broadly, the art of transmitting articulate speech by electricity."

"Broadly, a variable resistance contact transmitter for electro-speaking telephones."

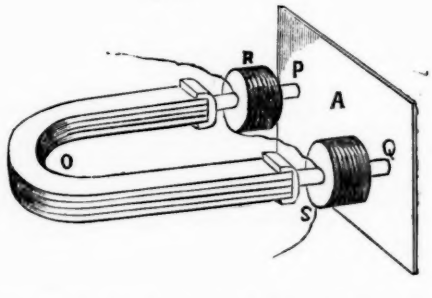
"Broadly, a magneto-receiver for electro-speaking telephones."

"The combination, substantially as hereinbefore set forth, of a transmitting membrane composed of vellum or any suitable material that is sensitive to the vibrations of sound, and a piece or pieces of conducting material receiving motion from the same, and a circuit-controller provided with means for adjustably controlling its vibrations in relation to said plate or plates and membrane, substantially as described."

Claim III. from A. G. Bell's Patent.

"The combination, with an electro-magnet, of a plate of iron or steel, or other material capable of inductive action, which can be

FIG.5.



thrown into vibration by the movement of surrounding air or by the attraction of a magnet."

To the Editor of THE ELECTRICAL REVIEW.

(*Translation.*)

SIR,—I have just read in the last number of the ELECTRICAL REVIEW a long letter from M. Barney on the case relating to the invention of the telephone, in which my name is incidentally brought forward in opposition to Mr. Bell. Allow me to point out to you that at the time when I published the first edition of my work, that is to say in October, 1878, I had had no other information than Mr. Gray's patents, and various pamphlets published in America by the same inventor.

Messrs. Bailey, Pope, and Haskins had also given me detailed information which seemed to me conclusive; and therefore at that time I thought that Mr. Elisha Gray, a very distinguished electrician, had had a great share in the invention of the telephone. The presentation of the two patents (Mr. Bell's and Mr. Gray's), which took place on Feb. 14th, 1876, at the office for American patents, also rendered the question very doubtful.

When Mr. G. Bell came to Paris in the month of November, 1878, to receive the prize awarded to him at the Exhibition of 1878, he explained to me fully the history of his discovery, and brought forward proofs in support of his claims which made me reconsider my first impression; but as at that time the lawsuit that he had to contest in America had begun, and he did not wish to destroy the force of his arguments, he requested me not to speak of it in the second edition of my work which I was then publishing, and that is why this second edition, although less in favour of Mr. Gray than the former one, did not relate the true account of Mr. Bell's invention. It is from this second edition that the English translation of my book has been taken. The third edition, although still more favourable to Mr. Bell, could not be as explicit as I could have wished, because the lawsuit was to continue; and it is only in the fourth edition, which is now published, that an exact account of the invention is to be found, taken from the authentic documents which figured in the case, and which Mr. Bell communicated to me on his last voyage to Paris. I have given a summary of them in *La Lumière Electrique*, February 4th, 1882.

In fact, it now seems clear to me that Mr. Bell was the first to make the telephone speak, that the whole invention rests in the application to musical telephones of undulatory currents adapted to the vibrations of the voice; for without these undulatory currents, which furnish all the intermediate shades of the vocal sounds, and which correspond to all the irregular sinuosities of these vibrations, one could only reproduce regular vibrations, and consequently only musical sounds.

Mr. Gray had, it is true, in his transmissions of combined sounds, employed currents of unequal intensity, but these were currents more or less superposed, and not working under the same conditions as the undulatory currents; and according to the evidence in the American lawsuit, these undulatory currents had been combined since 1874 by Mr. Bell. Besides, his first trials of the speaking telephone date from 1875, as is shown in the entire correspondence exchanged at this time between Messrs. Bell, Hubbard, and Brown. Therefore, in my opinion, Mr. Bell's rights are now incontestable.

In the letter which you publish mention is made of an invention, by Mr. M'Donough, very similar to that of Bell, patented April 10th, 1876. I am not acquainted with your English patent laws, but as Mr. Bell's specification is dated Feb. 14th, 1876, in America, it seems to me that in the eyes of every impartial man the invention belongs to the person who has been the first to make it known to an authorised patent administration; and from this point of view also Mr. Bell is entitled to be considered the true inventor. I ask your pardon for dwelling on this subject, but I should be very sorry for my name to be quoted in support of an injustice; and if I have committed one in the first edition of my work, it is because I was in want of exact information at that time. Hoping that you will kindly insert this correction, I beg to offer you the assurance of my sincere regard.

TH. DU MONCEL.

Paris, *Feb. 18th*, 1882.

NEW PATENTS—1882.

730. "Apparatus for measuring and registering electric currents." C. A. FAURE. Dated Feb. 15.

740. "Improvements in electric lamps or regulators and in generators of electricity for use therewith." A. M. CLARK. (Communicated by Solignac & Co.) Dated Feb. 15.

749. "Telephonic exchange systems and apparatus." G. L. ANDERS. Dated Feb. 16.

756. "Machines for producing electric currents." J. BROCKIE. Dated Feb. 16.

758. "An improved telegraph instrument." F. J. CHEESBROUGH. (Communicated by W. A. Shaw.) Dated Feb. 16.

760. "An improved dynamo-electric or electro-dynamic machine." C. W. SIEMENS. (Communicated by E. W. Siemens.) Dated Feb. 16.

761. "Dynamo-electric and magneto-electric machines." C. J. CHUBB. Dated Feb. 16.

766. "Generation, storage, distribution, regulation, and utilisation of electricity, and apparatus, methods, or means, to be used therefor, or in connection therewith." J. S. WILLIAMS. Dated Feb. 16.

774. "Protecting cables or wires for conducting electricity." J. C. MEWBURN. (Communicated by A. M. Jarriant.) Dated Feb. 17.

819. "Electric lighting apparatus for railway trains and other moving vehicles or vessels." S. PITT. (Communicated by E. T. Starr.) *Complete.* Dated Feb. 20.

821. "Improvements in electric telegraph and messenger systems, and in apparatus adapted thereto." C. N. TALBOT. Dated Feb. 20.

831. "Improvements in electric lamps, applicable also to other purposes." J. RAPIEFF. Dated Feb. 21.

834. "Electric lamps or lighting apparatus." W. R. LAKE. (Communicated by B. Lande.) *Complete.* Dated Feb. 21.

837. "Apparatus for collecting and storing electric currents." J. L. PULVERMACHER. Dated Feb. 21.

838. "Dynamo-electric machines." W. R. LAKE. (Communicated by B. Lande.) *Complete.* Dated Feb. 21.

ABSTRACTS OF PUBLISHED SPECIFICATIONS, 1881.

2711. "Electric danger alarms or signals for railways," &c. AL BURTIS PUTNAM. Dated June 21. 8d. The object of this invention is to warn the engineer or engine-driver of a train when there is danger ahead. For this purpose an automatic electric alarm is provided on the locomotive which shall operate whenever the train is following too closely after its leader, whenever it is approaching an open draw or misplaced switch or other source of danger, whenever it is approaching another train on a single track, or whenever there is a defect in any of the electric circuits employed. The figure is a

side elevation, showing a portion of the track with two locomotives passing in the same direction, the electrical devices being shown in diagram. In this figure, T designates the railway track, which is assumed to be one track of a double track road, on which trains run in the direction of arrow 1; L, L, are locomotives or engines thereon; G is an electric current generator on each locomotive, which may be, as shown, a magneto-electric machine run by a donkey engine or other power, or it may be a battery; A is an alarm apparatus in the cab of the locomotive, which is adapted to give a visual or audible signal of danger to the engineer, and which tends constantly to give such signal, but is normally restrained therefrom by the armature of an electro-magnet, C, which is normally attracted by said magnet; B is a metallic or conducting brush carried by the locomotive, and arranged to sweep the rail in advance of the forward wheel, or following the rear wheel, as preferred. This brush serves to form an electric connection with the rail, and is insulated from the locomotive. A wire, 2, connects the brush, B, with the magnet C; another wire, 3, connects said magnet with the generator G; and another wire or other conductor, 4, connects said generator with the wheel, R, of the locomotive. In ordinary running (as shown at the left hand or following locomotive) a closed electric circuit is maintained on the locomotive, the current flowing from G, through 3, C, 2, B, the rail R, and 4, back to the generator (or in the contrary direction). Only one of the rails may be used as a part of this circuit. So long as this closed circuit is maintained the alarm, A, is restrained from denoting danger, but whenever the circuit is broken or the current ceases flowing the alarm is no longer restrained, and it at once acts and the engineer is warned of danger. The figure shows the track provided with means for "block signalling," in order that

a train may receive warning in case it is following too closely after a preceding train. The track is divided into sections or blocks, the dividing points of which are marked "point A," "point B," &c. At each of these points is placed an insulated section of rail, I, between the ends of adjacent rails, H and J, of the track, T. From the rail, H, a wire, 5, extends to a contact point or screw, *a*, and from the rail, I, a wire, 6, leads to a contact lever or key, *b*. When *b* is in contact with *a*, the circuit, I, 6, *b*, *a*, 5, H, is completed with the exception of the break between rails H and I, and when the locomotive reaches the right hand position in fig. 1 with its brush, B, on the soil, I, and its wheel, E, on the rail, H, the current from generator, G, passes through 3, C, 2, B, I, 6, *b*, *a*, 5, H, E, and 4, and the circuit is not broken, but if *b* is away from *a* then such circuit is broken at *a*, *b*, and when the locomotive reaches said position (which is called the "signal receiving position") with its conductors, E, B, straddling or bridging the break between H and I and then the circuit is broken, the magnet, C, releases the alarm, A, and the danger alarm is given to the engineer. The lever, *b*, is acted upon by two electro-magnets, D and S, which constitute a signalling apparatus or relay, K; D is the "danger magnet," being the one which sets the apparatus to danger, that is, when it is excited it draws the lever *b* out of contact with the point *a*, so that the danger alarm will be given to the engineer. S is the "safety magnet," which, when excited, draws the lever *b* into contact with the point *a*, so that a passing locomotive shall receive no signal. A wire, 7, leads from rail I to magnet D, a wire, *s*, leads thence back to the magnet S, at the preceding point, and another wire, 9, leads thence forward again to the rail J, at the starting point, as clearly shown. An earth circuit may be substituted for either 8 or 9. When the locomotive has advanced shortly beyond the "signal receiving position" it reaches the "signal transmitting position," shown in dotted lines in the figure, wherein the conductors, B, E, bridge the break between rails J and I. In this position the current flows through 3, C, 2, B, J, 9 (back to preceding point), S, 8 (forward again), D, 7, I, E, and 4. In so doing it excites magnet D at (for instance) "point C," thereby setting the relay, K, there to "danger," and it also excites magnet S at the preceding point (for instance, "point B"), thereby setting the relay, K, there to "safety." Thus the locomotive in its passage first assumes a position to receive a danger signal if there be one to receive, and it then assumes a position to set the relay, K, which it has just passed, to "danger," and the one at the preceding point to safety.

2761. "Electro-magnetic induction machine for dividing a direct current into alternate currents." LORENTZ ALBERT GROTH. (A communication from abroad by Désirée Lachaussée, of Liège, in the kingdom of Belgium.) Dated June 24. 6d. Fig. 1 is a front view, partly in section, and fig. 2 a side view of the apparatus, showing the principal parts also in section. This machine is composed essentially of two plates, A and A', of magnetic metal or alloy, which serve as bases to a certain number of magnetic bobbins, B, placed side by side, but in such a way that a bobbin taken separately always offers a polar surface of opposite kind (antimone) to that of its two neighbours, and even if necessary to that which is opposite to it in the other plate. These two plates, which are very heavy, and move with the axis of rotation, C, form fly wheels, and thus

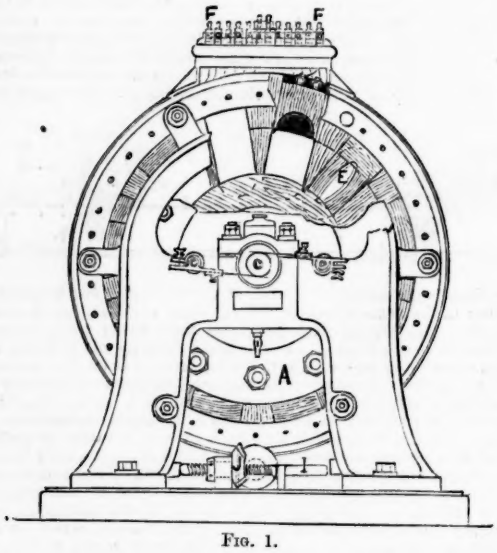


FIG. 1.

furnish their contingent of regularity in the distribution of the induction current. They are placed at a distance from one another, and separated by a fixed drum, D, in the thickness of which are placed any suitable number of metallic spirals, E, of small thickness, but of a diameter sensibly equal to that of the electro-magnetic bobbins. The induced bobbins of the drum may be removed from their places, each of them being contained in a wooden or other box, and carried by a support of gun metal, brass, or other metal, as non-magnetic as possible, in such manner that each bobbin may be taken out of the machine even while it is working. This is seen clearly in figure 1, which shows both the bobbin, E, complete in place, and also this same place when the cover is removed. The same figure also shows the rubbers by which the current is taken off. This arrangement allows of constantly verifying the state of each of the parts susceptible of heating, of changing the bobbins instantly without stopping, and of leaving in the machine only the number of elements necessary for the desired number of lights, and thus to reduce the motive power proportionately to the required production of electricity. The spirals are composed of a certain quantity of metal in wires or strips, wound round a very subdivided magnetic material, or even wound simultaneously on the wires or strips. They

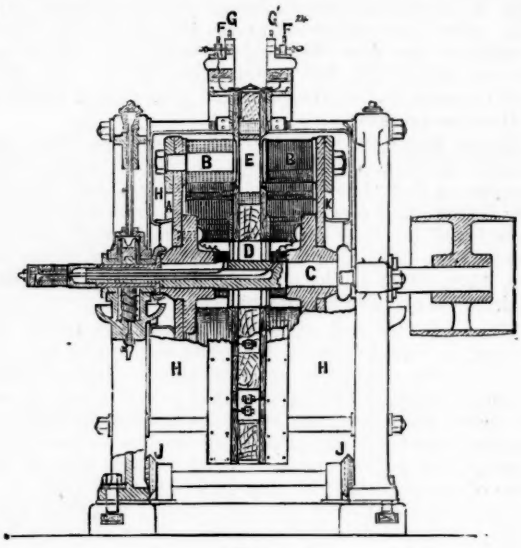
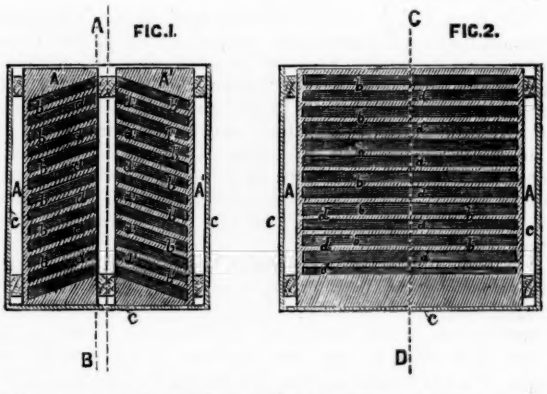


FIG. 2.

have no retaining rings, in order to avoid the unutilized effects of induction, which are hurtful, as they heat up the apparatus. These spirals are each independent of its neighbour; they may either receive separate rheophores, or one, two, or several common rheophores in such manner that they may be all put in tension one upon the other, or employed separately. For this purpose all the ends of the wire spirals are connected to small terminals F^1 to F^{24}, parallel to which are placed large terminals, G and G', which serve to connect these to one or more general or return wires, and allow of grouping the currents in tension or in quantity, even when the machine is working, without changing in any way the general arrangement of the machine.

2782. "Secondary batteries." H. E. NEWTON. (A communication from abroad by the Société Universelle d'Electricité Tommasi, of Paris.) Dated June 25. 6d. It has been found by experience that the amount of electricity accumulated in a secondary battery depends upon the extent of surface attacked by the current and the thickness of the layer of peroxyde formed. Further, the prompt charging of the secondary element depends upon the facility with which the metal is attacked and rendered spongy. The object of this invention is to produce a secondary battery in which these conditions will be realised. Fig. 1 is a cross section of a secondary



battery constructed according to this invention, and taken on the line C, D, of fig. 2, and fig. 2 is a longitudinal section of the same taken on the line A, B, fig. 1. A, A', is a pair of flanged lead plates of about two millimetres in thickness, cast with a series of shelves *b*, *b'*, of corresponding thickness inclining upwards. The shelves are arranged about five millimetres apart, and the angle at which they are set will be from thirty to forty degrees. These flanged plates A, A', are placed opposite one another about one centimetre apart in a vulcanite or other suitable vessel *c*. The spaces between the shelves are filled with sheets of lead foil of about one-tenth of a millimetre in thickness. These sheets of lead foil may be placed regularly in the spaces, as indicated at *d*, fig. 1, or irregularly, as indicated at *d'* in the same figure. The vessel *c* is filled with water, acidulated with sulphuric acid in the proportion of one to ten ($^1/_{10}$), and the battery is then charged like an ordinary Planté

battery. Owing to the extreme thinness of the lead foil carried by the shelves *b*, *b*, *b*, and *b*¹, *b*¹, *b*¹, the extent of surface to be chemically attacked is very great, and the metal, which before being placed in the spaces is almost equal to spongy lead, dissolves freely. The inclination of the shelves prevents the peroxide, which is formed under the action of the electric current, falling to the bottom of the vessel *c*. As a modification of the above arrangement of secondary battery the lead foil is dispensed with, and the plates A, A¹, with their shelves *b*, *b*, *b*¹, *b*¹, are made of an alloy of lead and tin. In this case the shelves are arranged closer together, viz., about two millimetres apart instead of five. The plates are severally treated to extract the tin from the alloy and leave the metal porous. This treatment consists in placing each plate in connection with the positive pole of a battery, and immersing it in a bath of water acidulated with sulphuric acid in the proportion of one to ten (1/10), and passing an electric current through the bath. All the tin will thus be dissolved out, and there will remain a spongy metal which constitutes the best secondary element, and one capable of being rapidly charged. The spaces between the shelves *b*, *b*, *b*¹, *b*¹, of the two plates A, A¹, are filled with pure lead filings or with lead precipitated from one of its salts by iron, zinc, or copper.

2788. "Apparatus for obtaining light by electricity." B. J. B. MILLS. (A communication from abroad by Francisque Million, of Lyons.) Dated June 25. Has for its object—First. To enable light to be given for a relatively long period, whilst the expenditure of electricity is reduced as low as possible. Second. To insure a fixed and regular light during the entire period of the duration of the light. Third. To arrange several lamps upon a single circuit, at the same time permitting of placing in action only those required, and with the certainty that the extinction of one of these lamps will not involve that of the others. These results are obtained, first, by the employment of long slender carbons guided and conducted by special means; second, by an improved arrangement of regulator; and third, by an automatic derivation of the current.

2807. "Telegraph cables," &c. A. C. RANYARD & J. A. FLEMING. Dated June 27. 2d. Relates more particularly to the production of telegraph cables, but it is also applicable to other conductors of electricity.—(*Provisional only.*)

2823. "Secondary batteries." A. P. LAURIE. Dated June 28. 2d. Has reference to the use of a battery containing a single fluid, viz., a solution of iodide of zinc in water, the plates of the battery being zinc and carbon. When a current is passed through the cell, zinc is deposited on the zinc plate, and iodine is set free at the carbon plate. The iodine is held in solution by the iodide of zinc. If the cell is now used to supply a current, the iodide of zinc attacks the zinc plate, the zinc set free at the carbon pole being dissolved by the free iodine.—(*Provisional only.*)

2825. "Apparatus for separating iron, steel, or magnetic oxide from other substances." E. HUNT. (A communication from abroad by John King, of Chili.) Dated June 28. 6d. Has for its object to separate iron, steel, or magnetic oxide from other substances by means of improved apparatus, in which magnets are applied in a novel manner, and so that the operation may be conducted in an expeditious and continuous manner.

2833. "Electric incandescent lamps," &c. G. G. ANDRE and E. EASTON. Dated June 28. 2d. A principal object of this invention is to produce incandescent burners which shall be lasting and suitable.—(*Provisional only.*)

2846. "Apparatus for transmitting sounds by electricity." E. J. PATERSON. Dated June 29. 2d. Relates to a means for simplifying and improving instruments used for transmitting speech or articulate sounds, and known as "carbon transmitters." According to this invention the diaphragm is dispensed with, and several carbon blocks are used, of which one or more are fixed firmly to a base and electrically connected to one pole of a battery, while the remainder are supported elastically from a fixed base, connecting them with the other pole of the battery.—(*Provisional only.*)

2930. "Electric lamps." E. P. WARD. Dated July 5. 2d. Has reference to the conveyance of the electric current into the lamp. According to the invention, iron or steel wires are substituted for the platinum ones usually employed in incandescent lamps. These are by preference connected directly to the carbons in the manner hereinafter described, and are connected to the glass bulb in the following manner:—Each wire is first inclosed in an envelope of glass, and the two envelopes are connected together by fusion at a suitable distance from one end. The combined envelope thus produced containing the wires is then united by fusion to the glass bulb for the latter to be exhausted, the glass envelopes forming a protection against any chemical action to which they might be subjected during manufacture. In lieu of employing glass a protective envelope for the wires of plaster, metal, or any other suitable material may be employed, the object being to protect the iron or steel against chemical action during the manufacture of the lamp. The inner ends of the wires are connected to the carbons by means of single spirals formed on the wires, and so arranged as to grip the ends of the carbons by their own elastic action without the intervention of any auxiliary binding material.

3015. "Electric lighting apparatus." W. R. LAKE. (A communication from abroad by J. J. C. W. Greb, of Frankfort-on-the-Main.) Dated July 8. 4d. Relates to improvements in electric lamps or lighting apparatus, the mechanism of which provides for a very sensitive and exact regulation, so that a number or series of the said lamps may be included in the circuit of a continuous, weak, or intermittent current in such a manner that one lamp will not disturb or interfere with the action of another; and notwithstanding the most sensitive regulation, the luminous point always remains the same as both carbons approach each other. Part of the mechanism is applicable for other purposes.—(*Provisional only.*)

THE ELECTRICAL EXHIBITION AT THE CRYSTAL PALACE.—The Swiss Government has appointed a delegate to inspect and report on the various exhibits, and the United States Naval Department, Washington, has also a representative engaged in a like task.

LECTURE ON THE PARIS ELECTRICAL EXHIBITION.—Sir John Bennett gave a lecture, we believe, last Thursday, at the "Bull Inn," Chiselhurst, on Paris and its Electrical Exhibition.

CHANGE OF ADDRESS.—Mr. Peter Brotherhood informs us that from the 1st March next his offices will be transferred to his new premises in Belvedere Road, Westminster Bridge, S.E.

CITY NOTES.

OLD BROAD STREET.

SUBMARINE TELEGRAPH COMPANY.

THE report of the directors states that the accounts for the six months ending 31st December, 1881, show a balance of profit which enables the directors to add the usual proportion of the gross receipts to the reserve fund, and to recommend a dividend at the rate of 19 per cent. per annum. The cables during the six months have not been interrupted more frequently than usual; but, unfortunately in the months of October and November three cables in the North Sea worked by the company were broken at the same time; and during the heavy gales prevalent in the latter part of November and beginning of December three cables between England and France were also broken, thus making six cables interrupted simultaneously, an event which had never previously occurred. As soon, however, as the weather moderated towards the middle of December, Mr. Bordeaux, the engineer of the company, repaired three cables in about eight days, viz., two between England and France, and one between England and Germany; and the directors have now the satisfaction of reporting that all the cables for the maintenance of which the company are responsible are again in good working order. In accordance with the terms of the resolution passed at the meeting of the proprietors on the 3rd August last, the company has been registered under the Companies' Acts, 1862 to 1880. It is with great regret that the directors announce the death of their esteemed and lamented colleague, Mr. Saunderson, who had been a shareholder for many years, and always took a great interest in the affairs of the company, even before his election as a director in the year 1861.

The half-yearly meeting of the proprietors took place on the afternoon of Wednesday, the 22nd instant, at the offices of the Company, 2, Throgmorton Avenue, London Wall. Sir James Carmichael, Bart., Chairman of the Company, presided.

The Secretary having read the notice convening the meeting, the Chairman said he presumed the report and accounts, having been circulated amongst the proprietors for some time, would be taken as read. He proceeded: "In moving the adoption of the report and accounts laid before you, I have great pleasure in calling your attention to the very satisfactory increase of traffic we have had during the past six months, which has enabled us to recommend a dividend of 19 per cent., to place £5,777 3s. 11d. to the reserve fund, and to carry over a balance of £709 7s.; besides which, we have also placed to the reserve £226 17s. 2d. for the purpose of repairing our steamer, so that in fact the total reserve fund at the present moment amounts to £100,486 8s. 2d. That is a very satisfactory position for this Company to be in. Besides which, this includes the cost of this building which we are in, which I consider to be a valuable asset. I have no doubt a little alarm has been caused by various statements in newspapers regarding the gales of wind and consequent injury to cables. But really we have not suffered more than usual from damage to our cables. You will see that the total cost of repairs during six months is not heavier than is generally the case. It is quite true that we had at one period no less than six cables broken simultaneously, which is very unusual, indeed an unprecedented occurrence. I may say that I think it reflects very great credit upon our engineer, that in the course of eight days three of these cables were put through, two in the English Channel and one in the North Sea. Perhaps you would like to know how much new cable was used in these operations. I am glad to say we have only used three miles altogether. Out of that only two miles were new, one mile being taken out of store from the old cables which were picked up and repaired in order to be laid down again as required. So that really we have only expended two miles of new cables in those repairs. That, as I have said, reflects very great credit indeed upon our engineer, and I am glad to bring it under your notice. Then, again, with regard to delays mentioned in the newspapers in consequence of the damages to the cables, I think that on looking into the question you will find that at least as much of that has been occasioned by accidents to the land lines as by accidents to the cables. The same storm which affects the cables is sure to affect the land lines, by blowing down a lot of the posts and the land wires. I have always found that there is quite as much delay in repairing the land lines as the cables, and last winter our cable to Boulogne was

working well, but only one wire on the French side was ready to take messages to Paris. The same thing happened at Beachy Head, where the post-office was unable to transmit our messages. As you are aware, deputations have been waiting on the Board of Trade, of gentlemen of influence and position in the telegraph world, who stated that they represented £27,000,000 of capital at the bottom of the sea. But they seemed to think that fresh legislation is required, and that we ought to be protected from the anchors of ships, from fishing boats, and similar dangers. They seemed to think that nobody had a right to the bottom of the sea except telegraph companies. I am not at all of that opinion, and I think injudicious legislation of a harsh or penal nature might do a great deal of harm. I don't think we need be very anxious to be protected, but one thing I would like to see is some distinct system of signals to be adopted by steamers on the telegraph service when engaged in repairing or laying cables. We want a system of signals for telegraph steamers, and then that some international law should be passed, compelling all fishing crafts in shooting their nets to give a wide berth to those steamers when so engaged. That is quite legitimate, and a very fair protection; but when it is proposed to legislate to bind fishermen not to fish in certain quarters, that is quite ridiculous, because our cables go over any amount of fishing ground, and I am sure that John Bull would complain just as much—for the fishing interest is a national one—if he did not get fresh fish every day for his dinner, as if his telegrams were delayed. Therefore I do not think it is wise to press for such legislation too much. In the same way as to ship's anchors: it is not possible to say that a ship must not anchor in a certain position because a cable lies there. Take a ship heavily laden beating up in a light wind against the tide, and it falls a dead calm. What is she to do? She must not drift, and out goes her anchor. If she uses proper precaution and care, even if she hooks the cable and lets it go again, no harm is done: if she does not, that is a question which we have tried twice. The ship *Spirit of the Age* was driven by stress of weather, and she hooked our cable and eventually broke it, but it prevented her going ashore. The Admiralty Court held that she was in the right, and that she could not help hanging on to our cable under the circumstances. Another case we had before the Admiralty Court, in which we proved that in calm weather a vessel caught our cable, wilfully held on, and then, instead of clearing it off the anchor, she chopped it. There we got damages. That was quite properly decided by the court, so I think that no more legislation is required on the subject: it needs only common sense. Therefore I should be quite satisfied, and so also should be my colleagues, if only sufficient protection from fishing crafts were granted to telegraph steamers engaged in repairs. At the present moment we have some little difficulties with fishermen, but we have always settled them amicably, and that is the best way to do it. If any nets are injured by our steamers, we compromise the matter; and if they injure us in any way, it has always been referred to the captains of the nearest ports, and so it has been arranged without any unpleasantness in a friendly manner. I don't know that I have much more to detain you with, except to allude to the death of an old and valued colleague, Mr. Saunderson, who has been about twenty years in the service of this Company, besides being an old shareholder. We deplore his loss, both as an old friend and as a very able man, particularly in the financial business of the Company. We are sorry to lose him, and regret his death in every way. The candidate for the vacant seat at the board is the Right Hon. Robert Bourke, and I have great pleasure in recommending his name to you as in every respect a suitable substitute. You are quite well aware that in a Company like this we require gentlemen of a certain position, I may say of a certain political position. I mean that we have a great deal of negotiation with different departments both of our own and foreign governments, and gentlemen in the position of Mr. Bourke are, of course, valuable additions to this Company, being, as he is, a member of Parliament and privy councillor, as well as under the late government Under Secretary for Foreign Affairs. We may safely recommend him to your consideration. Before sitting down I will just call attention to a case, of which the little printed paper before you has given some details, regarding Mr. Jacob Brett. Perhaps none of you might have had any personal knowledge of him, but his brother, some of the older shareholders may remember, was for many years on this board. I am sorry to say that he is, as you will see, in great distress, and I trust that your own kind feeling will prompt you to vote some reasonable sum to his assistance to-day. Of course it will not properly be a legal vote, because it ought to be brought before you by proper notice, but it could be done by confirming it at the next meeting. I think I have nothing else to allude to, except to apologise for the absence of one of our directors, Sir Julian Goldsmid, who is just now in the south of France, and of Sir Thomas Dakin, who is also in the south of France, detained, I am sorry to say, by ill-health—the one an auditor and the other a member of the board. With these remarks, gentlemen, I beg to move the adoption of the report and of the accounts presented to you.

Mr. H. C. Forde seconded the motion. He said that with reference to the remarks about the signalling on board ship, he thought that they had signals assigned to them by the Board of Trade—three lights at the mast-head at night. But unfortunately these were also the signals for ships in distress. He had mentioned it to the Board of Trade a year ago. The Admiralty had given them proper signals, but the Board of Trade had altered them. But he had no doubt that the influence of the directors would soon alter that unfortunate position of affairs. The disadvantage of it was that in the middle of the Atlantic and elsewhere their lamps acted like a lantern to flies.

The motion was put to the meeting, and carried unanimously.

The Chairman begged to propose, in accordance with the recommendation of the report, that the dividend for the past half-year be declared at the rate of 19 per cent. per annum, free of income tax.

Mr. Rains seconded the motion, which was carried unanimously.

The Chairman then further moved that the Right Hon. Robert Bourke, M.P., be elected as director for the seat at the board vacant by the death of Mr. Saunderson.

Mr. C. V. Boys seconded the motion, which was carried unanimously.

Mr. H. C. Forde said that with reference to the remarks made about Mr. Jacob Brett, he had great pleasure in bearing testimony as far as he was able to the fact of his late brother, Mr. John Brett, being one of the fathers of this Company; and as they had been very successful, and as he did not live to see its great success, it would be only doing a little justice to his memory if they did something to the relief of his brother. He had great pleasure indeed in proposing that a sum of not less than—say, £200 be contributed to the fund on his behalf, which was none too much for a Company paying 19 per cent.

Mr. Boys seconded the motion.

Sir Arthur Otway, Bart., M.P., would suggest that the matter might be left more to the discretion of the directors. He knew nothing of the circumstances of the case before them, but he thought that the money so gracefully voted should be carefully administered. He had observed lately in the newspapers a correspondence signed by a gentleman who signed himself a pioneer of submarine telegraphy, and who stated that he was acting in behalf of the submarine telegraph companies. Certainly he was not acting on behalf of *the* Submarine Telegraph Company: in fact, he had had no communication with that company. He considered that Mr. Brett was justly entitled to be called the pioneer of submarine telegraphy. As to the legislation justly and properly required for the protection of our cables, the remark from Mr. Forde was a particularly interesting and valuable one, and he hoped that the matter to which he referred would receive elucidation. That the signals formerly granted by the Board of Admiralty were useful and good, but that afterwards new signals were granted by the Board of Trade that were so far from being useful or fitting that they were almost mischievous, was a matter that could easily be remedied by the Board of Trade. He had no doubt whatever that arrangements could be made to get a code of signals that would be quite satisfactory.

Mr. Forde's resolution, that a sum of £200 be granted to Mr. Jacob Brett, was then put to the meeting, and carried unanimously.

Mr. Forde then moved a vote of thanks to the Chairman and the Board of Directors, which was duly carried, and

The Chairman having briefly replied, the proceedings terminated.

THE DIRECT UNITED STATES CABLE COMPANY (LIMITED).

THE ninth ordinary general meeting of the above company was held on the 17th inst., at the Cannon Street Hotel, the chairman of the company, Mr. John Pender, M.P., presiding.

The Secretary, Mr. J. W. Fuller, having read the notice convening the meeting, the Chairman said: Gentlemen,—You have had the report (an abstract of which appeared in the ELECTRICAL REVIEW of Feb. 18) in your hands for some time, and I presume you will take it as read. Before, however, asking you to adopt the report, I shall as usual quote a few figures, to show the variations that have occurred during the last six months. As shown by the report, the revenue for the last half-year, up to 31st December, after deducting out payments, amounts to £64,514 4s. 4d., and the working and other expenses, including interest on debentures and income tax, were £25,574 10s. 2d., leaving a balance of £38,939 4s. 2d. as the net profit for the half-year, making, with £7,179 10s. 8d. brought forward from the previous half-year, a total of £46,119 4s. 10d. This amount has been appropriated in the following manner:—Interim dividend of 5s. per share up to 30th September, 1881, £15,177 10s.; interim dividends of 5s. per share up to 31st December, 1881, £15,177 10s.; amount carried to the reserve fund, £11,141 4s. 2d.; balance carried forward, £4,623 0s. 8d.; making the total of £46,119 4s. 10d. The half-year shows an increase of about £4,700 over that for the corresponding period of 1880, but owing to the various tariffs in operation during the two half-years, no reliable comparisons of the two can be made. With regard to the shilling tariff, which is now in operation, I shall refer to it more in the general remarks I am about to make. Passing to the expenditure, it will be seen that although on the whole we have spent less than during the corresponding period of 1880, certain items in the working charges show an increase. "Salaries, wages, house allowance," &c., stand first with an increase of £1,116. The increased number of hours during which the duplex system is worked in the cables, as compared with the time when the system was first adopted, as also its recent application to the short cable, has rendered necessary the employment of an increased staff, and this fact is mainly responsible for the extra outlay. The additional cost of travelling expenses by £184 arises from the cost of despatching the clerks to their respective stations. Printing and stationery show an increase of more than £180, and that is wholly attributable to the increased consumption of message forms and other stationery. The remaining items show little variation as compared with 1880, and therefore call for no remark. As shown by the accounts, the reserve fund amounts to about £250,000, and the Company's investments remain the same as at the previous half-year. The interest on them now amounts to £10,000 per annum. Gentlemen, these figures, so far as they go, are satisfactory, and show you exactly what reasons we have for our slightly increased expenditure. Now, gentlemen, on an occasion like the present, I think it is well that almost every word that I give utterance to should be carefully and well considered. I think, therefore, looking to the position which we now occupy, and to the competition which may shortly arise, it is right that I should give the shareholders such information as it is desirable that they should possess, and which we are anxious should be given, so that they may act in perfect concert with the directors. Having given you the figures showing the

working of our system for the last six months, it may be interesting to you, before putting the resolution, if I give you all the information I can, as just stated. And let me congratulate you on the fact—and a very important fact it is—that during the past year we have not had any interruption of our cables, and that at the present moment they are in perfect working order. When I had the pleasure of addressing you six months ago, I went very fully into the subject of the position which the English Submarine Companies' cables held, and the advantages they conferred on the telegraphing public. I contrasted the liberal policy adopted in the reduction of the rates and the policy pursued by the land system in America since they came under new management, and I have nothing further to add to what I then stated on the subject. But I think it will interest you if I give you some information as to the effect which the shilling tariff has had on our receipts. When I referred to the threatened Gould Company's competition six months ago, it was said that one cable was laid and another in the course of being laid. The new Company did as a matter of fact open in September last with a tariff of 1s. 6d. per word as against our 1s., but their cable only worked for a few days; and if I am rightly informed, in attempting to repair the second cable they cut through their first, consequently at the present moment their cables are not yet completed. But assuming, as we have a perfect right to do, that soon their cables will be in working order, there will then come the competition; but if the Western Union Company, the great land system of telegraphy in America, fulfil their contract obligations to the existing Atlantic companies, there ought to be no question as to the strength of our position. If, on the other hand, these obligations are departed from, and the Western Union Company divert traffic due to the old companies to the Gould Company, the competition may prove not only severe, but the existing contracts between the Anglo and the Western Union may be disturbed. I may say that I consider these contracts legally maintainable, but if they were broken they would involve a very large sum of money for damages, and of course we should be guided by legal advice as to the best means of protecting our interests. I am, however, hopeful that having regard to the fact that one of the directors of the Anglo-American Company has now become a director of the Western Union Company, that those obligations which are binding legally and morally will be honourably fulfilled, especially as he was a party to those contracts made between the Anglo and Western Union Companies in the early days of Atlantic submarine telegraphs. I think I have afforded you sufficient information on this point, and it would be inexpedient to go further into this question, which may possibly require to be judicially decided. Now, gentlemen, as to the shilling tariff. In my last address to you I stated that we had not adopted the shilling tariff merely as a fighting tariff, but that we believed it would be an enormous boon to the telegraphing public. We anticipated that the increase of traffic would more than compensate for the loss sustained by the reduced rate. I have only to say that we have so far been disappointed in this anticipation; but when we consider that the shilling tariff in 1877 only yielded £870 per day, and that now it is yielding about £1,670, it shows us that it has taken about five years to develope it to that extent. Believing as we do that there is still an enormous development in submarine telegraphy, we think we can scarcely expect that it would be more rapid in the next five years than in the last. Consequently it must take at least from four to five years to produce the same revenue under the one shilling as we were earning under the two shilling tariff. The next thing which I daresay will interest you to know, and which I should also like the public to know, is this: that had we not duplexed our cables it would have been quite impossible to transmit the traffic now carried at the shilling rate without additional cables. The duplex system costs the different cables under £8,000 per annum, giving us about the same carrying capacity as five new cables, which would have cost in interest alone from £200,000 to £250,000 per annum. Therefore it is clear that the duplex and other scientific appliances, which we have adopted, alone have enabled us to make the trial with the shilling rate; but with all these advantages I doubt if we should be able to do the amount of work under the shilling rate which would make up the amount earned under the two shilling rate. But that you may thoroughly understand this point, I may say that we could do this work, and have a considerable margin, provided we could keep our cables full for twenty-four hours a day throughout the whole year; but as the important part of our business is found to fill only sixteen hours out of the twenty-four, and as the average of our cables in use may be said, taking into account breakage, to be five instead of six, I am bound to admit that I am not sanguine of the shilling rate proving satisfactory to the shareholders—that is to say, if we put by a sufficient sum to the reserve fund which I believe is an absolute necessity for maintaining our system. The reserve should accumulate to a sum equal at least to that which has hitherto been set aside for the purpose, and I think no hesitation should be shown in doing so, looking to the fact that Atlantic cable property at the present moment stands in the market at 50 per cent. discount. Unless we are prepared, by means of such a reserve fund, to replace our cable when it shall be worn out, it will be impossible to obtain money from the public to replace that cable unless, to speak very plainly, gentlemen, we spend two prices for it. Gentlemen, you will all agree with me that we must go upon the principle of making existing cables pay for their own replacement. These are plain statements. They are not, you will see, very sanguine as to the position of submarine telegraphs; but yet in the face of this uncertainty of telegraph property, there never has been any want of persons who seem to be attracted to it. It is quite true that there are existing manufacturing companies who will, of course, endeavour to keep their wheels running, and also persons who have some good causes for promoting this particular enterprise; but I think it well to state plainly that any new companies who may lay cables to compete with the present tariff at one shilling, will find, in the first place, that their property will fall by 50 per cent., and that the return on the original capital, if a reserve fund is to be put aside at all, will barely pay working expenses, even if they have traffic to fill their cables. So I cannot conceive that we are likely for some time to come to have new companies springing up to lay cables in the Atlantic; but when the two new competing cables come into operation, and they get their full share of the traffic which we may assume that they may get, unless there is a development of traffic equal to what they take from us, then the decrease in revenue which is now 33 per cent. may become to the existing companies 50 per cent. You will therefore see that we have a decreasing revenue and an increasing expenditure, for the additional words to be carried require an extra staff. But that you may understand exactly what the shilling tariff is earning at present, and how it is likely to influence our dividends in future, I may mention that the combined companies were earning something like £900,000 at two shillings, but at the one shilling rate we have been earning during the last six months only at the rate of £600,000 per annum. The fact is, we require to carry 66 per cent. more traffic under existing conditions to make up the revenue to what it was under the two shilling rate; and for the reasons I have given it is doubtful whether the combined companies could do it, taking into account the various interruptions and limited hours to which such companies are liable. I am sure you will not ask me to say anything further on this subject. We have given you all the information we possess ourselves. We think it would be wrong to know anything that would be detrimental to your interests without putting it plainly before you. I have done that to-day, and you must now form your own judgment. While we continue to manage your affairs, we shall do it in your interest, so far as our judgment and our ability enable us, and I trust that the experience we have had in managing submarine telegraph property will enable us, at all events, to place you in the best position that you can be placed in during any competition that may arise, and it will always be our first consideration to secure, under all circumstances, the best dividend that we can for our shareholders. With these remarks, I beg to propose the resolution, which is, "That the report of the directors, dated 8th February, 1882, together with the statement of accounts to the 31st December, 1881, annexed thereto, be, and the same hereby are, adopted." But before putting that resolution to the meeting, I shall be glad to hear any remarks from any of the shareholders upon the statements that I have just addressed to you.

No remarks being made, the resolution was seconded by William Ford, Esq., and carried unanimously.

This being all the business, a vote of thanks to the Chairman and directors was moved by Mr. Newton, seconded by Mr. Segelcke, and carried unanimously, to which the Chairman briefly responded, and the proceedings terminated.

MEDITERRANEAN EXTENSION TELEGRAPH COMPANY, LIMITED.

THE forty-ninth ordinary general meeting of the shareholders of the above company took place on Monday last, in the Cannon Street Hotel, Sir James Carmichael, Bart., chairman of the company, presiding.

The Secretary, Mr. Edward Tombs, having read the notice convening the meeting,

The Chairman said he presumed the report—(see ELECTRICAL REVIEW last issue)—and accounts would be taken as read. He proceeded: In moving the adoption of the report and accounts, I need only detain you with a very few remarks. As to the report it is so far satisfactory that you see our revenue exhibits an increase over the preceding twelve months by a sum of upwards of £1,000, which has so far enabled us to reduce the amount which we are entitled of call upon the Treasury to guarantee. It will be in the recollection to some shareholders present that at the last meeting it was decided, on the recommendation of your directors, to enter into negotiations with the Eastern Telegraph Company, to ascertain, if possible, whether some amalgamation or sale of the property of this company could not be carried out. Accordingly we made a proposal to the Eastern Telegraph Company with this object in view. I think I should remind you that no formal resolution was adopted, but the general impression of the shareholders present, and the one with which I went away from the meeting, was that about £3 would be a fair price for the ordinary stock. I left the room under that impression, and upon that we acted in our proposal to the Eastern Company. We suggested to them that they should take over the whole property of this company, including our cables, though not, of course, our reserve fund, and give us in return for every £10 ordinary share 3 per cent. debenture stock, bearing interest at 5 per cent., and for the preference 8 per cent. stock, that they should take it over at par, and pay it off in debenture stock at £4. That was the proposal made; in my opinion it was a very fair and liberal offer. Of course it was made subject to your approbation. I am sorry to say that this was met by a distinct refusal, and up to this time we have had no counter proposal. I do not think that was a hard proposal to make; but we should like to have your authority before we make any further proposal. The next question discussed was whether, as our guarantee is now coming to an end—it will expire at the end of the present year—we should appeal to the Treasury with an application for its continuation. Pending the negotiation with the Eastern Telegraph Company, in my opinion, that would have been inexpedient. You can easily understand why. Because, supposing we had met with a refusal, our property would have been deteriorated, so to speak, and it would have been so much less easy to drive a bargain. Therefore we thought it prudent and wise to await the decision of the Eastern Company, and have the decision before us before we approached her Majesty's Government. But supposing the negotiations with the Eastern should be carried through, I should then strongly advocate

memorialising the War Office and the Admiralty, pointing out the importance of a second communication with Malta, which is every day becoming of more importance, on account of our connection with the East, especially in view of our relations with Egypt. If the Government were approached on the subject of such a communication with Malta, especially if supported by the War Office and the Admiralty, I see no objection on the part of the Treasury to give us a guarantee. It is quite possible we should not obtain the same amount of guarantee as we do now. That was given when Corfu was an English possession,—at all events, under our English flag. Since we parted with Corfu, the English Government have now no interest in maintaining her communication with it; but they always have an interest in maintaining their communication with Malta. The amount of guarantee originally given to us was to the extent of £7,200 a year. During the 24 years of this company's existence, taking the average of what we have drawn from the Treasury, I am happy to say it amounts to only about half that sum. Therefore, if the Government should reduce our guarantee, we don't want £7,200 a year. Putting Corfu out of the question, if they will only give us a certain amount, and guarantee us, say, reasonably for the line between Malta and Sicily, we should remain in our present position waiting for better times. When the time comes to go to the Government we shall have a strong case, because if things had remained in the original state when this company first started and when its lines were first laid down, we should never have come upon the Government for a single penny of the guarantee; but the Government, not for political but for parliamentary purposes—to please a certain clique in Parliament—allowed another company to bring a line to Bona, and from Bona to Malta, which entirely took away our profit. There was no imperial policy, no British policy involved in that, they simply considered that they need not keep Malta closed against other telegraph lines. We pointed out what would occur if only this line were allowed to land at Malta, that the Government would be necessitated to pay the sum, because our profit was entirely abstracted. Unfortunately, it was quite admitted by the Treasury; they admitted our arguments, but said that such a measure would be so unpopular that they could not take upon themselves to do it, and that therefore they must take their chance of having to pay us. Therefore the Treasury themselves were really the people who caused the depreciation of the company's property and brought upon themselves the payment of the guarantee. It is a very strong case for us indeed. It was no fault of ours that they had even to pay half of the sum guaranteed; it was entirely their own doing, and instead of asking them for the sum of £7,000 we let them off for less than half of it. It would be quite worth while for a country like this to pay £3,000 a year to have a communication with Malta independent of France, as the rest of these lines coming round by Lisbon are continually liable to be interrupted. I do sincerely and fervently hope that the Government may have the good sense and patriotic feeling to give something to this company to maintain this second line. I need not detain you further on this subject. We are entirely in your hands. We have told you what we have done and what we propose to do. We should like to hear whether we are to make any further offer, and we should be very much obliged if you would say whether you are prepared to go on or what sacrifice you are prepared to make. I need only move the adoption of the report, and if any shareholder will kindly second it, I will not put it until the whole thing is discussed.

The Honourable Ashley Ponsonby seconded the motion.

Mr. J. T. Edmonds thought that at the present juncture the directors should put themselves in communication with Government in order to get a continuation of the guarantee either on the present or on some other terms such as you suggest.

Mr. Atrell thought that they ought to get something out of the present Government. Seeing they were inclined to give other people's money, he did not see why they could not get some for themselves. As to the Eastern Company there ought to be some pressure put upon them; but he thought the directors had in their hands power to see what could be done, and report to the shareholders afterwards.

The Chairman said that the only question was whether they had gone to the extreme in asking £3 for their shares, whether they might not reduce their demand to £2 10s., or £2, or even 30s. It was for the shareholders to say whether they were satisfied.

Several shareholders signified their opinion that the company had gone quite far enough, and that £3 was the least they should take, one gentleman stating that £3 was a par price, and he thought they could not go below the market.

In reply to a question as to the resolution of the company if the proposed arrangement with the Eastern was carried out, the Chairman said that they had one whole good cable between Malta and Sicily, and one between Corfu and Otranto. These with the reserve fund of about £15,000, and a concession from the Italian Government, with about eight years to run, would not leave them absolutely beggars. Replying to a question by Mr. Edmonds, the Chairman said that if the reserve fund came to be divided, they had a legal opinion taken about two years ago that the ordinary would rank with the preference shareholders in that division.

Mr. Atrell asked whether in the event of the guarantee falling through, and the company being left with this whole cable between Malta and Sicily, would that cable be sufficient to earn the 8 per cent. for the preference shares and leave anything over for the ordinary shareholders? The Chairman thought that this cable, with the addition of the other between Corfu and Otranto, would earn enough to pay at all events the preference shareholders.

In reply to Mr. Johns, it was stated that in the event of the company amalgamating with the Eastern, it would wind up voluntarily, and the reserve would be distributed amongst the shareholders, ordinary and preference.

Mr. Atrell hoped that in the event of joining the Eastern Company due provision would be made for the officials and servants of their company.

The Chairman then put his motion for the adoption of the report and accounts, and the declaration of the dividend therein stated, to the meeting, and it was carried unanimously.

A vote of thanks to the chairman and directors, on the motion of Mr. Atrell, was also carried, and the proceedings terminated.

THE TELEGRAPH CONSTRUCTION AND MAINTENANCE COMPANY, LIMITED.—The annual report of the company shows a net profit of £72,300, exclusive of £77,735 brought forward. After allowing for the interim distribution of 5 per cent., the directors propose a dividend of 15 per cent., making a total return of £2 8s. per share, tax free, and leaving £60,395 as an undivided balance, to be credited to the current year's accounts.

THE GREAT NORTHERN TELEGRAPH COMPANY.—We were notified on the 17th instant that the Shanghai-Hongkong cable has been repaired, and telegrams for Hongkong and Manila are therefore again accepted by this company. Since then we have been informed that the company's Shanghai-Amoy cable has also been restered. Telegrams for Amoy are again accepted at the company's London station, and at all post-office telegraph stations. The company's lines to all stations in China and Japan are now again in perfect working order.

LATEST QUOTATIONS.

Authorised Issue.	Share.	Name.	Paid.	Closing Quotations. Feb. 22.	Business Done.
		ELECTRIC LIGHT.			
40,000	10	Anglo-American Brush Co.	4	8 - 8¼	8¼.8.$\frac{1}{16}$
		Do. Do.	10	21½- 22½	21½
150,000	1	Electric Light and Power Generator Co.	1	⅞- 1⅛	1⅛.1.$\frac{7}{16}$
		TELEGRAPHS.			
2,116,400*l.*	Stk.	Anglo-American, Limited	100	49 - 50	48⅞ xd.
2,441,800*l.*	Stk.	Do. Preferred } Def'd. receiving no div. until }	100	77 - 78	77½.8.1.1xd
2,441,800*l.*	Stk.	Do. Deferred } 6 p. c has been paid to Pref. }	100	19½- 20½	19⅞ xd.
130,000	10	Brazilian Submarine, Limited	10	11 - 11½	
16,000	10	Cuba, Limited	10	8½- 9	8½
6,000	10	Do. 10 per cent. Preference	10	15½- 16½	
13,000	10	Direct Spanish, Limited	9	5½- 5⅝	
6,000	10	Do. 10 per cent. Preference	10	14½ 15½	
65,000	20	Direct United States Cable, Limited, 1877	20	10 - 10½	10.8.10
100,000*l.*	100	Do. 6 per cent. Debenture, repayable 1884	100	100 -103	
380,000	10	Eastern, Limited	10	9⅝- 10⅛	10⅛
70,000	10	Do. 6 per cent. Preference	10	12⅜- 12⅝	12⅜
232,000*l.*	100	Do. 6 do. Debentures, repayable Oct. 1883	100	101 -104	
200,000*l.*	100	Do. 5 do. do. Aug. 1887	100	99-102 {	100⅞.12.100⅞
200,000*l.*	100	Do. 5 do. do. Aug. 1899	100	102 -107	
199,750	10	Eastern Extension, Australasia & China, Limited	10	10⅝- 11¼	11
320,000	100	Do. 6 p. c. Debentures, repayable Feb. 1891	103	105 -109	108
500,000	100	Do. 5 p. c. (Australian Gov. Subsidy) Deb. 1900	100	101 -104	
140,000	100	Do. do. registered, repayable 1900	100	101 -104	
100,000*l.*	100	Do. 5 per cent. Debenture, 1890	100	102 -105	
254,300*l.*	100	{ Eastern and South African Limited 5 per cent. } { Mort. Deb. Registered redeemable 1 Jan. 1900 }	100	101 -104	
345 700*l.*	100	Do. do. do. To Bearer	100	101 -104	
22,050	10	German Union Telegraph and Trust, Limited	10	9½- 10	
163,390	10	Globe Telegraph and Trust, Limited	10	6 - 6⅛	6⅛.6
163,209	10	Do. 6 per cent. Preference	10	12 - 12½	12⅛.¼
125,000	10	Great Northern	10	11½- 12	11⅝
100,000*l.*	100	Do. 5 per cent. Debentures	100	100 -103	101⅛
31,200	10	India-Rubber, Gutta-Percha and Telegraph Works	10	23½- 24½	
100,000	10½	Do. 6 per cent. Debentures, 1886	100	104½-108	
17,000	25	Indo-European, Limited	25	28 - 29	
35,148	10	London Platino-Brazilian, Limited	10	4⅜- 5⅛	
12,000	10	Mediterranean Extension, Limited	10	2⅝- 3	
8,200	10	Do. 8 per cent. Preference	10	9½- 9⅝	
9,000	8	Reuter's, Limited	8	12½- 13	12½
280,000	Stk.	Submarine	100	270 -280	
58,225	1	Do. Scrip	1	2⅛- 2⅜	
4,200	Cert.	Submarine Cables Trust	100	97 -100	
37,350	12	Telegraph Construction and Maintenance	12	29½- 30½	30⅛.⅛.30
150,000	100	Do. 6 per cent. Bonds, 1884	100	101 -105	
186,750	5	Do. 2nd Bonus Trust Cert.	5	1½- 1⅝	1$\frac{5}{16}$.$\frac{5}{8}$
30,000	10	West Coast of America, Limited	10	4½- 5	
150,000	100	Do. 8 per cent. Debentures	..	..	
69,910	20	Western and Brazilian, Limited	20	8⅛- 8⅜	8⅛.⅛
200,000*l.*	100	Do. 6 per cent. Debentures "A" 1910	100	105 -110	
2,500	100	Do. 6 p.c. Mort. Deb. series B of '80. red. Feb., 1910	100	98 -101	
1,500	$1,000	Western Union of U. S. 7 p.c.1 Mort.(Building)Bds.	$1,000	123 -128	
1,030,000*l.*	100	Do. 6 per cent. Sterling Bonds	100	104 -107	
88,321	10	West India and Panama, Limited	10	1⅛- 1⅜	1$\frac{9}{16}$.$\frac{5}{8}$
34,563					
4,669	10	Do. 6 per cent. 1st Preference	10	7½- 8	
	10	Do. 6 do. 2nd do.	10	6 - 6½	
		TELEPHONES.			
154,165	1	Con. Telephone & Maintenance, Ld. Nos. 1 to 154,165	1	1⅛- 1⅜	1⅛
200,000	1	Oriental Telephone Co.	½	⅜- ½	
100,000	5	United Telephone Co.		12 - 12½	

* Exceptional amount at special price.

TRAFFIC RECEIPTS.

The West Coast of America Telegraph Company, Limited. The gross earnings, traffics and steamer included, for the month ending January 31st, 1882, were £2,300 against £2,025 for the corresponding period of last year, showing an increase of £775. For the half-month ending February 14th, 1882, £1,875, against £900 for the corresponding period of last year, showing an increase of £975.

The Western and Brazilian Telegraph Company, Limited. The traffic receipts for the week ending February 17th, 1882, were £2,583, after deducting the "fifth" of the gross receipts payable to the London Platino-Brazilian Telegraph Company, Limited.